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Some characteristics of the sediments of healthy and degraded reed stands at Lake Fertő/Neusiedler See

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Abstract. Changes in the electric conductivity, pH, redox potential, temperature, PO_4^{3-}, NH_4^+, NO_3^-, SO_4^{2-}, S^{2-}, Cl^-, Na^+, K^+, Mg^{2+}, Ca^{2+}, total carbon (TC), total *organic carbon (TOC) and total nitrogen (TN) concentrations of the sediment interstitial water and in the electron transport sys*tem activity (ETS), litter associated fungal biomass (as ergosterol), organic matter content (LOI) of the sediment were studied in healthy and degraded reed stands at the Hungarian part of Lake-Fertõ /Neusiedler See. Based on the results of the multivariate statistical analyses, significant differences have been found between the healthy and die-back sites.

INTRODUCTION

In wetland ecosystems, which are among the most productive ecosystems (Mann & Wetzel, 2000), the largest part of the organic material production is formed by emergent macrophytes, playing an important role in the detritus food chain (Wetzel, 2001). This macrophyte originated detritus is finally accumulated in the sediment, where it undergoes through different physical, chemical, and microbiological transformations.

At Lake Fertő/Neusiedler the largest input of organic matter is originated from the high *Phragmites australis* (Cav. Trin. ex Steudel) production (Dinka *et al.,* 2010). *Phragmites australis* is a cosmopolitan plant species, it has functionally adapted to the anaerobic conditions of the sediment by transporting oxygen into the rhizosphere (Armstrong & Armstrong, 1998) and favouring the oxidation of the reduced chemical compounds as well as the microbial oxidation processes (Azzoni *et al.,* 2001).

The microbial mineralization of organic matter – which is carried out by microbial communities of variable compositions (Fenchel & Blackburn, 1979), using sequentially different electron acceptors (Jones, 1985) – is highly influenced by the presence or absence of oxygen and has a remarkable influence on the chemical composition of the sediment and sediment interstitial water (Berner 1980). The products of bacterial metabolism (CO_2, CH_4, NO_3^-, NH_4^+, H_2S, PO_4^{3-}) enter into the sediment interstitial water (Gaillard, 1993). In the sediments the majority of microorganisms are attached to the sediment surface and only a minor portion of them may be found in the sediment interstitial water (Hirsch & Rades-Rohkohl, 1988; Griebler, 1996).

In the Hungarian part of Lake Fertő/Neusiedler the purposeful hydrobiological research began in the 1970s with a gradually increasing spectrum and became an international field of interest for hydrobiologists (Dinka, 2007). The previous comprehensive studies on sediment and water chemistry conducted at Lake Fertő have been concentrated mainly on the open water areas and inner ponds (Dinka, 1994).

In the last few decades several authors have reported changes in the structure of the reed (Ostendorp, 1989; Armstrong *et al.,* 1996), which is connected with the reed degradation processes. The analyses of the influence of reed stands on the biogeochemical cycles in the aquatic ecosystems and the degradation processes which have been observed in Central-Europe stimulated the comparative investigations of the healthy and degraded reed stands. Based on these analyses, aligned research was carried out in 8 countries from 1993 to 1999 in the frame of EU-EUREED I–II program and it was pointed out among the

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others that the quality of water and sediment had a direct influence on reed die-back (e.g. Čížková *et al,*. 2001; van der Putten, 1997).

The studies conducted in the framework of EUREED program at Lake Fertő/Neusiedler See, have elucidated that the reed stands with different health conditions differ in many aspects from each other (Dinka & Szeglet, 1999, 2002). These previous findings have justified the wider investigation of the sediments of reed stands at Lake Fertő/Neusiedler See (Dinka, 1998, 2001; Ágoston-Szabó, 2004, 2007), which may also influence the habitat diversity.

The aim of this study was to compare the healthy and degraded reed stands on the basis of the chemical parameters of surface and sediment interstitial water and the microbial activity of the sediment. The hypothesis was that the sediment interstitial water chemistry and the microbial activity of the sediment are significantly different in the healthy and degraded reed stands.

Study area

Lake Fertő or Neusiedler See (Hungarian and Austrian name, respectively) situated on the Hungarian–Austrian border (47° 42' N, 16° 46' E, Fig. 1) has a surface area of 309km^2 (Hungarian part 75km^2), with a mean depth of 1.1m. 54% of the whole lake and 85% of the Hungarian part is covered by reed, characterised by an enhanced detritus accumulation and mixing effect of the wind, therefore the sediment water interactions are more intensive.

Sampling sites were selected in the Hungarian part of the lake. The chemical characteristics of the water and interstitial water were examined at three sampling sites (Fig. 1):

– Site 2 is a homogenous reed area, situated in a healthy reed stand, with consistent gray coloured sediment.

– Site 3 is a degraded reed area, characterised by clumped distribution of the culms, consistent, black coloured sediment with negative redox conditions, high organic matter content and S^{2-} concentrations, which induce the callus blocking of aerenchyma channels (Armstrong *et al.,* 1996).

– Site 3.1 is a replanted, young reed area in the reedless region of the degraded reed stand (site 3) with less consistent, black coloured sediments. At this site (3.1) samples were taken both from the water among reed shoots and the unvegetated areas of the thinned reeds area. The different character of these plots will be referred as "in" (in reed tussocks, among reed shoots) and "out" (unvegetated area around the reed tussocks) in the figures.

MATERIALS AND METHODS

Surface and interstitial water

Interstitial water was taken from 0–20 and 20–40cm sediment layers (from plastic sampling tubes previously set at the sampling sites); the reason for choosing these layers was that 80% of the reed rhizome system is found in the above 40cm sediment layer.

The electric conductivity, pH, temperature of the water and interstitial water were determined on the spot. The redox potentials were determined in the laboratory with calomel electrode (Pt), and expressed versus normal hydrogen electrode by adding +240mV (Eh of saturated calomel electrode).

The Na^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, SO_4^{2-}, NO_3^- concentrations were determined by Dionex ionchromatograph (DX-120). The PO_4^{3-} and NH_4^+ concentrations of the interstitial and surface water were determined with standard chemical analysis (Felföldy 1980, Golterman *et al.* 1978), while the S^{2-} concentration was measured with iodometric titration, after $ZnCl_2$ precipitation (Golterman *et al*. 1978).

The total carbon (TC), the total organic carbon as non-purgeable organic carbon (TOC) and the total nitrogen (TN) concentrations of the sediment interstitial water were determined by TOC analysator (liqui TOC).

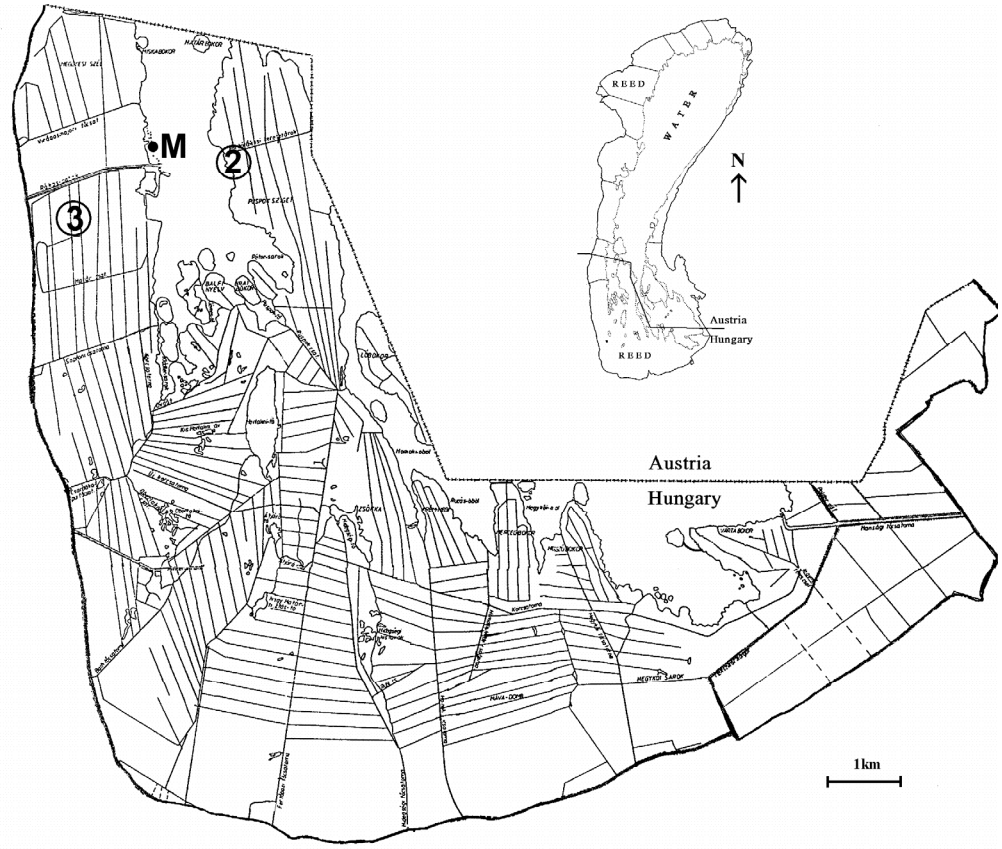

Figure 1. Sampling sites at Lake Fertő. 2 – healthy reed stand site, 3 – degraded reed stand site (including site 3.1 which is not indicated on the map), M – Meteorological Station

Sediment

Sediment cores were collected at each sampling site with plastic sampling tubes of 1 meter (diameter: 19.5cm). Subsamples from the 0–5cm, 19–20cm and 39–40cm layers (in which most part of the rhizome system occur) were placed in a crucible, and dried to constant weight at 105 ^{o}C for 24h for determination of the moisture content, then combusted at 450 ^{o}C (Molnár & Dinka, 1997; Jungwirth, 1979) for 4h in a muffle furnace for determination of organic matter content by loss on ignition method (LOI).

Litter associated fungal biomass was estimated by extracting and quantifying ergosterol from sediment samples (Gessner & Newel, 1997; Bååth, 2001).

The electron transport system (ETS) assay described by Kenner & Ahmed (1975), Owens & King (1975), and modified by Broberg (1985) was used to determine the potential microbial respiratory activity of the sediment.

Data analysis and statistical methods

An analysis of variance, Pearson's correlation and cluster analysis were performed using the Statgraf 1.0 for Windows and Past software packages (Hammer *et al.,* 2001) and only the results of the statistical analyses are given in this study.

Data of sampling

Samples were collected on 19/09/2006, when the water level of the lake was 96cm (115.47m above the Adriatic See level, which is an average water level) at the gauge of Fertőrákos.

RESULTS

Surface and interstitial water

In situ measured parameters

The temperature of the surface water varied between 19.1–19.2 ºC and decreased in the function of the sediment depth with 0.3–1.0 ºC until the 0–20cm sediment layer, and by 0.3–0.5 ºC until the 20–40cm sediment layer.

The redoxpotential of the surface water varied between (-53.0) – 183.4 mV, the lowest values were recorded at site 3.1 (Fig. 2). The redox values decreased (but not significantly, $p>0.05$), in the function of the sediment depth.

The pH values in the surface water ranged from 7.9 to 8.5 (Fig. 2), and significantly ($p<0.05$) decreased in the function of the sediment depth at each sampling site.

The electrical conductivity of the surface water varied between 3.5–4.2 mS cm^{-1} and significantly ($p<0.05$) increased with the sediment depth (except for site 2) (Fig. 3). At site 2 it was lower than at site 3 and 3.1 both in the water and sediment interstitial water.

Nutrient concentrations

The PO_4^{3-} concentrations of the surface water ranged from 0.03 to 1.51 mg l^{-1} (Fig. 2), and increased with the depth of the sediment until the 20cm, then decreased until the 40cm, but these variation were not significant at $p<0.05$ level.

The NH_4^+ concentrations varied between 0.18–0.46 mg l^{-1} and the NO_3^-concentrations between 0.06–0.44 mg l^{-1} in the surface water (Fig. 2), the concentrations of both compounds increased with the depth of the sediment, but significantly ($p<0.05$) only the NH_4^+ concentrations at sites 3 in and 3.1 in.

These redox sensitive nutrient compounds (PO_4^{3-}, NH_4^+, NO_3^-) showed a strong negative correlation with the redoxpotential both in the water and sediment interstitial water (with the exception of PO_4^{3-} in the 20–40cm sediment layer) (Tab. 1).

The TC concentrations varied between 387.8–733.9 mg l^{-1}, the TOC between 163.8–377.8 mg l^{-1} and the TN concentrations between 5.9–10.9 mg l^{-1} in the surface water, and the highest values were measured at site 3.1 (Fig. 2). The TN concentrations significantly increased ($p<0.05$) in the function of sediment depth (with the exception of site 3.1 out), while the TOC and TC concentrations showed a significant increase ($p<0.05$) only at site 3. The highest TOC and TN concentrations were measured in the sediment interstitial water of site 3.

In each of the investigated samples a strong positive correlation was found between the TOC-TC, TOC–TN concentrations and between the TIC–TC, TIC–TN concentrations, respectively (Tab. 1).

Strong negative correlation was found among the TC, TOC, TN concentrations and the pH, redoxpotential of the sediment interstitial water (Tab. 1).

The TN concentrations of the water showed a stronger positive correlation with the NO_3^- (R^2= 0.99) concentrations than with the NH_4^+ concentrations (R^2=0.71), while it was inverse in the deeper sediment layers (0–20cm: $R^2_{TN\text{-}NH4}$ = 0.60, $R^2_{TN\text{-}NO3}$ = 0.47; 20–40cm: $R^2_{TN\text{-}NH4}$ = 0.86, $R^2_{TN\text{-}NO3}$ = 0.08). The TOC concentrations of the sediment interstitial water showed a strong correlation with the LOI of the sediment (0–20cm: $R^2_{TOC\text{-}LOI}$ = 0.87, 20–40cm: $R^2_{TOC\text{-}LOI}$ = 0.97).

The TC:TN molar ratio in the surface water ranged from 75.6 to 83.4, and it was higher than in the sediment interstitial water (0–20cm: 61.8–80.9 and 20–40cm: 56.97–88.5).

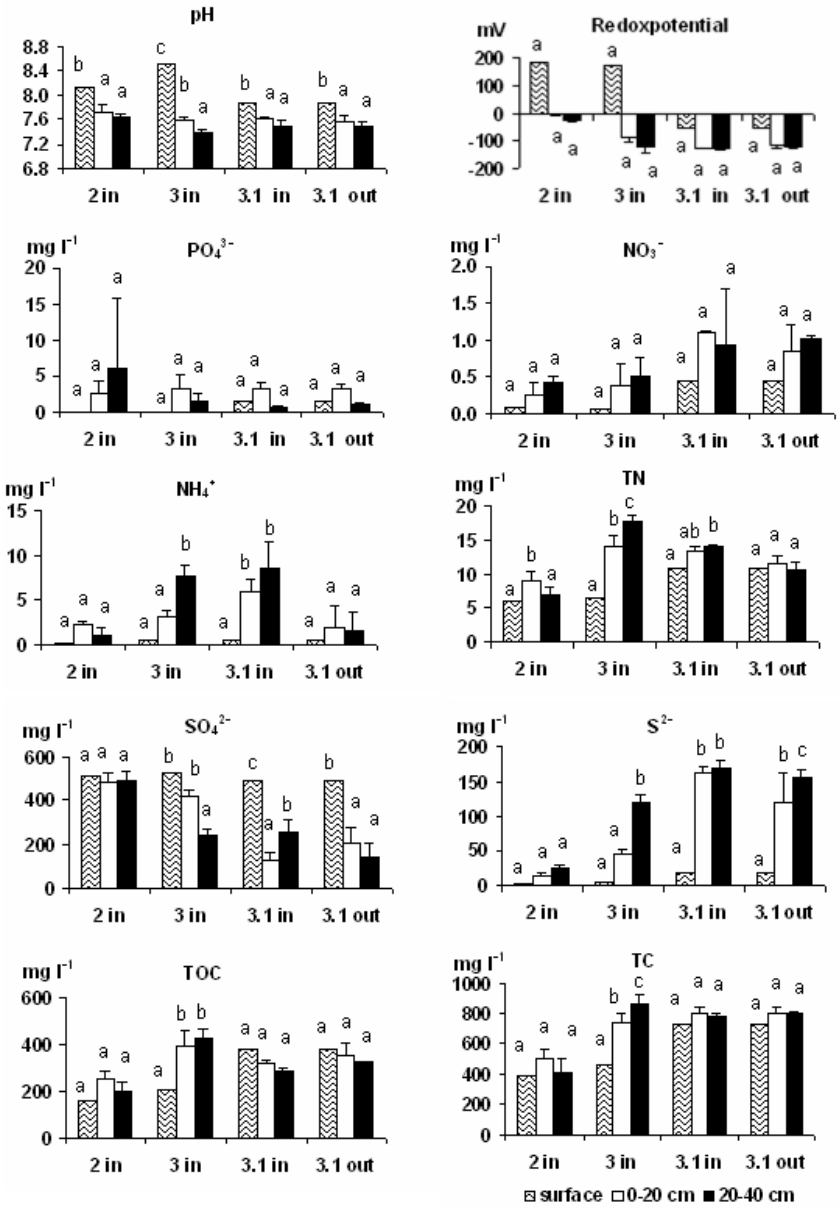

Figure 2. Changes in the chemical parameters of the surface and sediment interstitial water (values followed by different letters are significantly different at the 0.05 probability level)

Changes in the concentrations of the main ions

The SO_4^{2-} concentrations of the surface water varied between 488.4-519.0 mg l^{-1}, the highest values were measured in the healthy reed stand (site 2). The SO_4^{2-} concentrations significantly ($p<0.05$) decreased in the function of the sediment depth (with the exception of site 2) (Fig. 2).

The S^{2-} concentrations varied between 2.2–19.0 mg l^{-1} in the surface water, the highest values were recorded at site 3.1, and significantly ($p<0.05$) increased in the function of the sediment depth (with the exception of site 2) (Fig. 2). The highest decrease in SO_4^{2-} concentrations and increase in S^{2-} concentrations were recorded at site 3.1.

Table 1. Pearson's correlations between some chemical parameters

	surface	0-20 cm	20-40 cm
TOC-TC	1.00	0.74	0.88
TOC-TN	1.00	0.82	0.89
TIC-TC	1.00	0.92	0.94
TIC-TN	0.98	0.62	0.69
TOC-pH	-0.72	-0.85	-0.97
TOC-redox	-0.99	-0.67	-0.75
TC-pH	-0.69	-0.97	-0.95
TC-redox	-0.98	-0.99	-0.98
TN-pH	-0.77	-0.78	-0.96
TN-redox	-1.00	-0.80	-0.77
SO_4^{2-}-redox	0.92	0.83	-0.96
S^{2-}-redox	-1.00	-0.85	0.99
SO_4^{2-}-NH_4^+	-0.31	-1.00	-0.98
S^{2-}-NH_4^+	0.70	1.00	0.97
SO_4^{2-}-PO_4^{3-}	-0.92	-0.51	0.98
S^{2-}-PO_4^{3-}	1.00	0.53	-0.98
SO_4^{2-}-NO_3^-	-0.94	-1.00	-0.57
S^{2-}-NO_3^-	1.00	1.00	0.85
PO_4^{3-}-redox	-1.00	-0.91	1.00
NO_3^--redox	-1.00	-0.85	-0.69
NH_4^+-redox	-0.66	-0.51	-0.63

The SO_4^{2-} concentrations positively, while the S^{2-} concentrations negatively correlated with the redoxpotential values both in the water and sediment interstitial water (Tab. 1). The NH_4^+, PO_4^{3-} and NO_3^- concentrations positively correlated with S^{2-} concentrations and negatively with the SO_4^{2-} concentrations (with the exception of PO_4^{3-} in the 20–40cm sediment layer) (Tab. 1).

The concentrations of the main cations: Na^+, K^+, Ca^{2+}, Mg^{2+} and of the Cl^- in most cases significantly ($p<0.05$) increased with the depth of the sediment (Fig. 3). A close correlation ($R^2= 0.828–0.999$) was found among the Na^+, Mg^{2+}, Cl^- concentrations and electrical conductivity both in the water and sediment interstitial water.

Changes in sediment characteristics

Organic matter content as loss on ignition (OM_{LOI}) varied from 10.5–58.0% (Tab. 2). At site 2, 3 and 3.1 in (in reed tussocks, among reed shoots) increased, while at site 3.1 out (unvegetated area) decreased in the function of the sediment depth. This increase was 2–9 times higher at sites 3 and 3.1 than at site 2.

ETS-activity varied from 0.17–0.27 mg O_2 g^{-1} h^{-1} in the surface sediment layer (Tab. 2) and decreased in the function of the sediment depth at each sampling site (by 11–71% until the 1–20cm and by 36–63% until the 39–40cm sediment layer).

The highest ETS activity values were measured at sampling site 3, where the loss on ignition values was also the highest. As comparing the site 3.1 in and 3.1 out higher ETS-activity, and higher loss on ignition values were measured outside the reed stand.

The correlations between the sediment ETS-activity and the chemical parameters of the sediment interstitial water can be seen on Tab. 3. Almost in each of the examined cases the ETS-activity of the sediment showed a strong positive correlation with the loss on ignition of the sediment.

Fungal biomass (as ergosterol concentrations) of the surface sediment layer varied from 8.3–41.5 μg l^{-1}, in most cases decreased in the function of the sediment depth (Tab. 2). Similarly to the ETS-activity and to the loss on ignition, the highest fungal biomass was measured at sampling site 3.

Comparison of sampling sites

According to the results of the two-way ANOVA analysis, (first component: site; second component: depth), there were significant differences ($p<0.05$) between the sampling sites.

Based on the chemical parameters of the surface and interstitial water, site 2 significantly differed from sites 3, 3.1 in and 3.1 out, while among the sites: 3, 3.1 in and 3.1 out there were no significant differences.

Taking into consideration the investigated microbial parameters of the sediment site 2 also

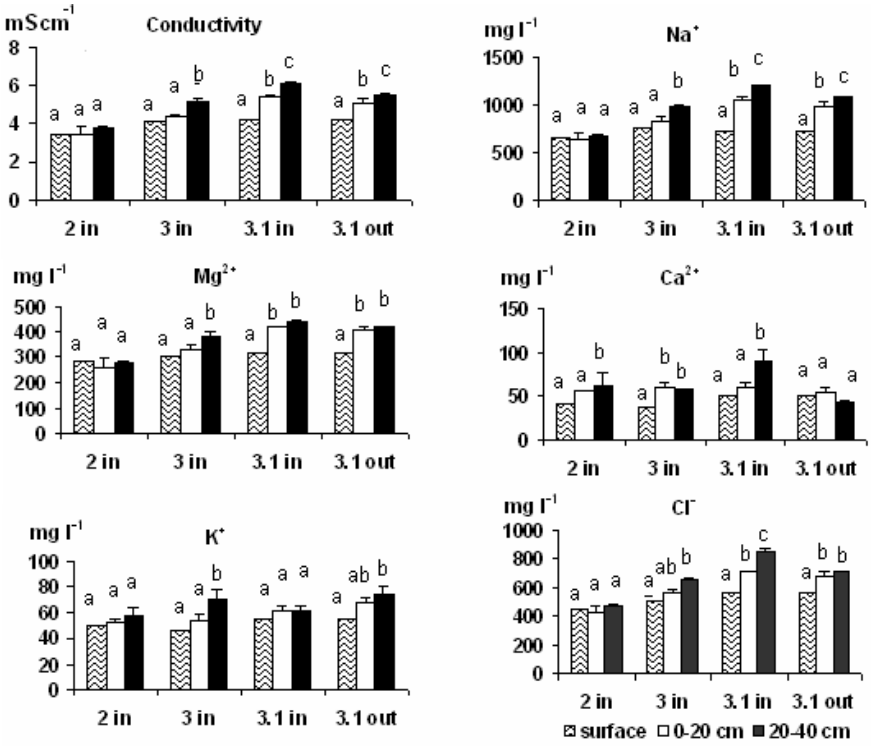

Figure 3. Changes in the electrical conductivity, Cl^-, Na^+, K^+, Mg^{2+}, Ca^{2+} concentrations of the surface and sediment interstitial water

Table 2. Changes in the ETS-activity, fungal biomass as ergosterol (ERG) and organic matter content as loss on ignition (LOI) of the sediment

	LOI [%]			ETS [mg O_2 g^{-1} h^{-1}]			ERG [µg g^{-1}]		
sites	0-5 cm	19-20 cm	39-40 cm	0-5 cm	19-20 cm	39-40 cm	0-5 cm	19-20 cm	39-40 cm
2 in	10.7	11.8	12.0	0.17	0.15	0.10	16.9	8.4	12.12
3 in	56.2	75.4	67.9	0.27	0.08	0.17	41.5	93.1	13.52
3.1 in	10.5	8.8	22.3	0.08	0.06	0.03	8.3	4.6	29.63
3.1 out	58.0	7.3		0.26	0.11		13.6	3.9	

significantly differed from sites 3, 3.1 in and 3.1 out; moreover, site 3 significantly differed from the sites 3.1 in and 3.1 out, but between the sites: 3.1 in and 3.1 out there were no significant differences.

The results of the PCA also reflected the separation of site 2 from the other investigated sampling sites both in the water and in the 0–20 cm and 20–40cm interstitial water (Fig. 4). In the 0–20cm sediment layer, site 3.1 in and 3.1 out were situated close to each other while in the 20–40cm layer a separation could be observed between them.

DISCUSSION

Chemistry of sediment interstitial water and the microbial activity of the sediment were analyzed in the function of the sediment depth and compared in healthy and degraded reed stands.

Similarly to the results of previous studies (Dinka 1998, 2001, Ágoston-Szabó 2004) the pH, redoxpotential, SO_4^{2-} concentrations, temperature decreased, while the electrical conductivity, cation, S^{2-} and Cl^- concentrations increased with sediment depth.

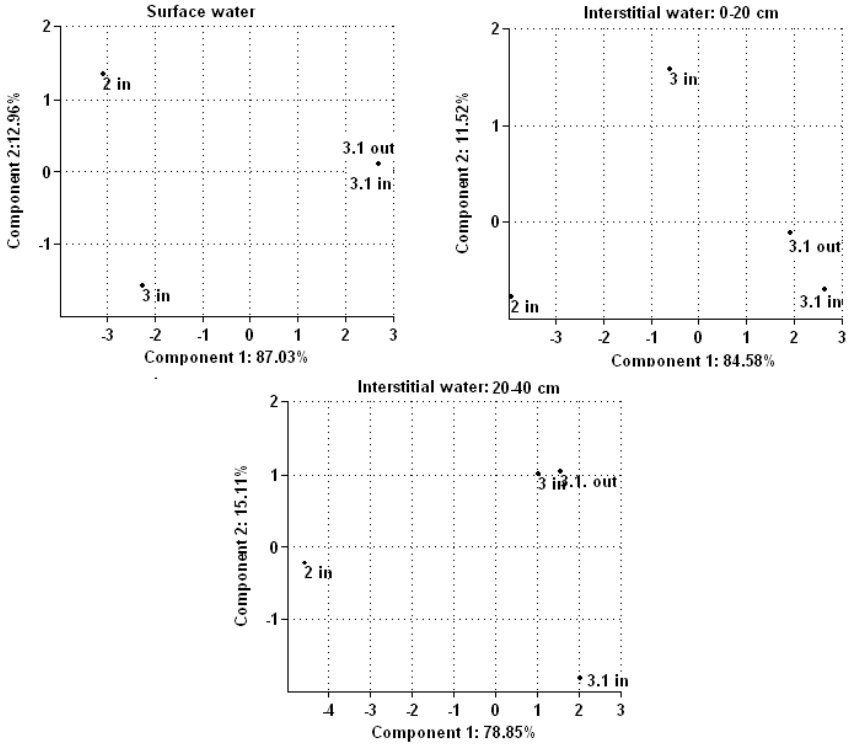

Figure 4. Principal component analysis of the sampling sites based on the chemical features of the surface and sediment interstitial water

Table 3. Pearson's correlations between the ETS-activity, fungal biomass (ERG) and the investigated chemical parameters

	ETS			ERG		
	0-5 cm	20 cm	40 cm	0-5 cm	20 cm	40 cm
Redox	0.83	1.00	0.06	0.68	-0.19	-0.51
pH	1.00	0.96	-0.38	0.98	-0.52	-0.83
Cond.	-0.17	-0.94	-0.39	0.07	-0.06	0.20
S2	-0.81	-0.80	-0.34	-0.64	-0.37	0.25
SO4	0.98	0.78	-0.06	0.92	0.39	-0.61
NH4	-0.14	-0.84	-0.12	0.10	-0.30	0.46
PO4	-0.83	-0.93	0.16	-0.68	0.60	-0.42
NO3	-0.86	-0.78	-0.78	-0.72	-0.39	-0.30
TOC	-0.75	-0.70	0.60	-0.57	0.87	0.95
TC	-0.72	-1.00	0.17	-0.54	0.30	0.69
TN	-0.80	-0.95	0.34	-0.63	0.55	0.81
LOI	0.88	-0.27	0.77	0.97	1.00	0.99
ETS	0.00	0.00	0.00	0.97	-0.27	0.83
ERG	0.15	0.83	0.38	0.00	0.00	0.00

The SO_4^{2-} concentration decrease in the function of the sediment depth was paralleled by the S^{2-} concentration increase due to the sulphate reduction, which is one of the dominant processes in the sediment of Lake Fertő/Neusiedler See (Armstrong & Armstrong, 1998; Dinka, 2001; Ágoston-Szabó, 2004).

The differences in the redox potential values and sulphide concentrations in the interstitial wa-

ter of the healthy and degraded areas may be due to the differences in the sediment organic matter content and in the *Phragmites* mediated oxygen transport, which influences the redoxpotential and the concentrations of the redox sensitive compounds in the sediment (Armstrong & Armstrong, 1998). Healthy reed shoots transport oxygen more efficiently into the rhizosphere than the die-back shoots (in which callus occlusion of aerenchyma frequently occurs Armstrong *et al*. 1996), where creates favourable conditions to the oxidation of reduced compounds and the detoxification of the sediment (Azzoni *et al.,* 2001).

Usually the increase in PO_4^{3-} concentrations in the function of sediment depth is the reason for the release of the iron bound phosphate and the decomposition of organic matter in reductive conditions (Istvánovics, 1988), unlike at Lake Fertő/Neusiedler See, where the organic matter content of the sediment is high and according to Dinka (1994), 60–78.5% of the sediment TP is bound to the Ca, 13–28% to the organic matter and only 14% is NaOH hydrolysable.

The analysis of inorganic nitrogen speciation in our study indicated an NH_4^+– N dominance in the surface and interstitial water, which suggests that the nitrate reduction may have been the dominant processes in N transformation in the sediment. The elevated NH_4^+ concentrations in the interstitial water may have been the result of degradation of N-containing organic matter (Van Lujin *et al.* 1999).

The organic matter content measured as TOC concentrations of the surface water accounted for 42–51% of TC and of the sediment interstitial water for 40–53% (0–20cm) and 37–49% (20–40 cm) of TC, respectively. The high total organic carbon concentrations at sites 3, 3.1 in (vegetated areas) and out (unvegetated area) can be related by the anaerobic environment at these sites, demonstrated by the low redoxpotential values of these sites. The mineralization of organic matter is slower under anaerobic conditions (Esteves *et al.,* 2001).

The high TC:TN molar ratio found in the surface and sediment interstitial water indicated a N limitation. The negative correlation of the TC, TOC, TN concentrations with the pH, redoxpotential and the positive correlation of the ETS-activity with the pH, redoxpotential of the sediment interstitial water indicated that the concentrations of the TC, TOC, TN are influenced by the impact of the pH and redox conditions on the microbial activities.

The increase in the concentrations of Na^+, Ca^{2+}, K^+, Mg^{2+}, Cl^- in the function of the sediment depth suggest that these ions are diffusing from the deeper sediment layers toward the sediment surface. Batty & Younger (2004) found that the depth profile of the Ca^{2+} is influenced by the degree of Ca^{2+} uptake by plants.

The positive correlation between the ETS activity, ergosterol concentrations of the sediment with the TOC, LOI indicated that the microbial activity is strongly interrelated with the sediment organic matter content.

CONCLUSION

Significant differences were found between the healthy and degraded sites based on the sediment characteristics, which demonstrated that the changes in the chemical parameters of the sediment interstitial water and in the organic matter content and microbial activity of the sediment are strongly interrelated with the condition of the reed stands. The correlation analysis showed that the microbial activity of the sediment was interrelated with organic matter content, pH and redoxpotential of the sediment. At die-back site there were no significant differences between the natural and replanted reed stands.

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Another species of the genus *Aporcelinus* Andrássy, 2009 (Nematoda: Dorylaimida)

I. ANDRÁSSY[1]

Abstract. A further new species of the recently established genus *Aporcelinus* Andrássy, 2009 is presented. *Aporcelinus decimus* sp. n. from Ecuador can be differentiated from all known species by the shape of the vulval lips and the tail. The former are sclerotized lying parallel with the body axis, the latter is relatively long, rapidly tapered at its middle, and more or less bent dorsally.

In a quite fresh paper (Andrássy, 2009), I was proposing a new genus of the aporcelaimoid nematodes, *Aporcelinus,* for species having a two-layered cuticle of different refraction, a small cardial lobe, bumpy eggshell, small ovoid spermatozoa, sclerotized vulva, unusually small male supplements continuously arranged with the adanal pair, and a more or less conoid tail. In the special structure of the cuticle, *Aporcelinus* Andrássy, 2009 is closely related to the genera *Aporcelaimellus* Heyns, 1965 and *Makatinus* Heyns, 1965. All they belong to the family Aporcelaimidae Heyns, 1965, and can be united under a separate subfamily, Aporcelaimellinae Andrássy, 2009.

Aporcelinus differs from *Aporcelaimellus* by the thinner cuticle never thickened so strongly on the tail, absence of a cervical lacuna, very small male supplements showing no precloacal space, and by the pointed tail. It differs from *Makatinus* by the same structures like in *Aporcelaimellus,* moreover by the number of the adcloacal supplements (one pair *vs*. two to five pairs).

I placed nine species under the genus, and designated *Aporcelinus diadematus* (Cobb in Thorne & Swanger, 1936) Andrássy, 2009 as type species.

When examined some older slides preserved in my collection, I just discovered another species of *Aporcelinus* that seemed to be new to science. This species is presented hereunder.

Aporcelinus decimus sp. n.

(Figs. 1 A–E and 2 A–C)

Holotype female: L = 1.35 mm; a = 23; b = 4.1; c = 28; c' = 2.0; V = 54 %.

Paratype females (n = 4): L = 1.32–1.42 mm; a = 21–27; b = 4.1–4.6; c = 25–32; c' = 1.7–2.1; V = 51–54 %.

Description. Body relatively small and robust, C-shaped after fixation, 52–64 µm wide at the middle region. Cuticle smooth, thin, 2.0–2.5 µm thick on most body, and 4–5 µm thick on tail; consisting of two layers which are especially distinct on the tail. Lip region slightly offset by a depression, 14 µm wide, lips angular, hardly separated. Body at posterior end of oesophagus 3.3–4.2 times wider than head. Amphids cup-shaped with aperture occupying about half a corresponding body.

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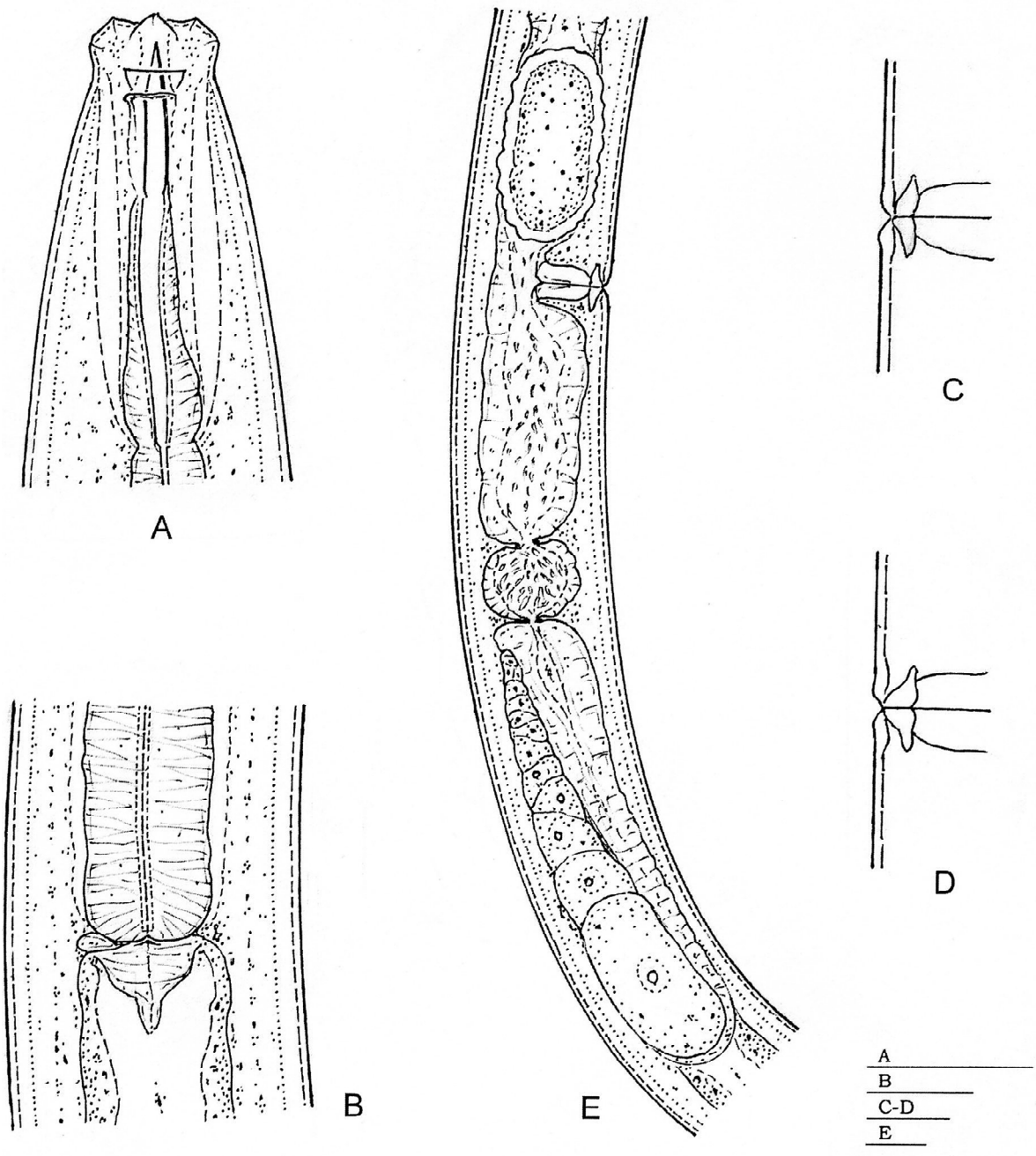

Figure 1. *Aporcelinus decimus* sp. n. A: anterior end; B: cardial region; C–D: vulval lips; E: detail of genital apparatus. (Scale bars 20 µm each)

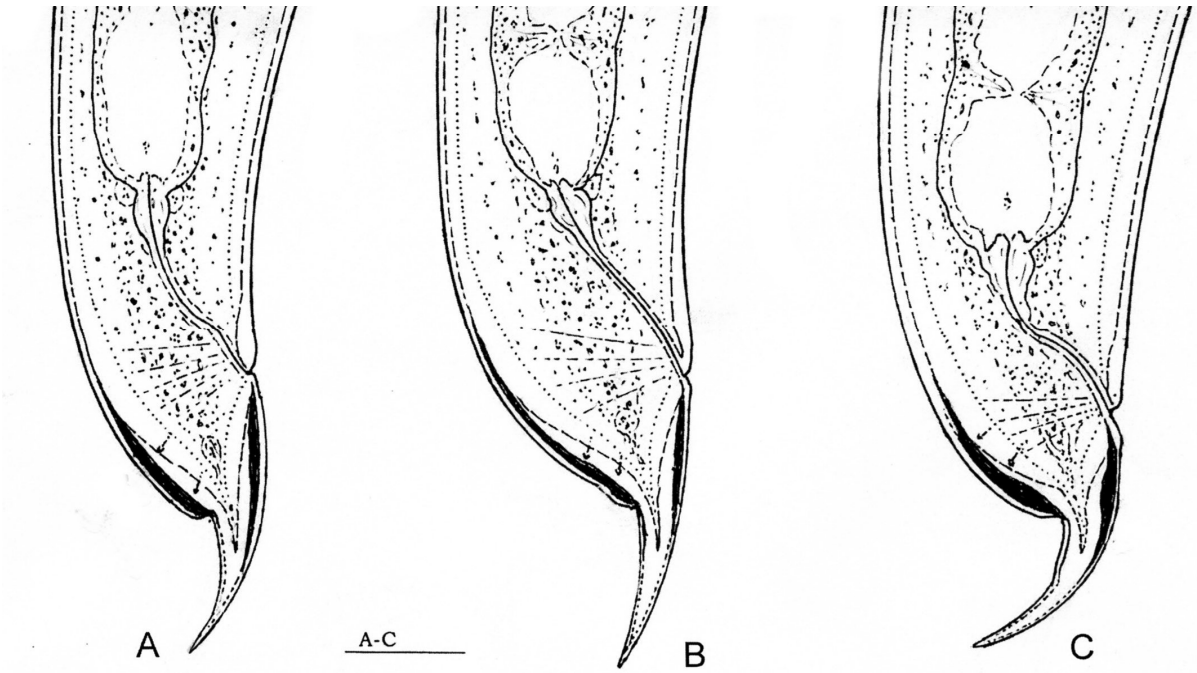

Figure 2. *Aporcelinus decimus* sp. n. A–C: female tail. (Scale bar 20 µm)

Odontostyle moderately long, 18–20 µm, as long as 1.3–1.4 labial diameters, conspicuously thicker than cuticle at the same level; aperture occupying one-third of stylet length. Guiding ring aporcelaimoid. Oesophagus 324–382 µm long, heavily muscular, gradually widened at 52–54 % of its length. Distance between proximal end of oesophagus and vulva always longer (1.2–1.4 times) than oesophagus itself. Dorsal nucleus located at 58–60 % of oesophagus length, or 14–15 % of total body length. AS1 nucleus inconspicuous. Location of the other nuclei: AS2 = 55–56 %, PS1 = 70–71 %, PS2 = 70–73 %. Glandularium 130–138 µm long. Cardia with a small, rather inconspicuous dorsal lobe. Rectum 1.4–1.7, prerectum 1.0–1.3 times the anal body width long.

Female genital apparatus didelphic, well-developed. Each branch as long as 5.6–6.2 body diameters, or occupying 22–25 % of entire length of body; anterior branch occasionally reaching close to cardial region. Vulva transverse with 20–25 µm wide sclerotized and divergent inner lips (arranged parallel with body axis). Vagina 28–33 µm long. Each branch of uterus with a large, spheroid, well-offset spermatheca. Ovaries lying on dorsal side of intestine. Uterine eggs one to five in number, 70–83×30–38 µm; eggshell undulated or wrinkled.

Distance between vulva and anus equal to 11–14 tail lengths. Tail 44–51 µm long, or occupying 3.1–3.9 % of entire length of body. It is very characteristic in shape: in its first half conoid-rounded, then strongly tapered and more or less dorsally curved. Tail tip pointed or finely rounded. Inner layer of caudal cuticle thicker than outer layer, and showing a different refraction.

Male not known.

Diagnosis and relationships. A smaller species of the genus, with thin cuticle, narrow and hardly offset head, relatively short odontostyle, short oesophagus, greatly developed female genital apparatus, sclerotized and divergent inner vulval lips, bumpy eggshell, very short prerectum and comparatively long and dorsally bent tail.

By virtue of the arrangement of the vulval sclerotization and the shape and size of the tail, this new species can unambiguously be distinguished from all known species of the genus. As for the shape of the tail – rapidly tapered at its middle and dorsally bent in the latter section – the new species may be compared with *Aporcelinus altitudinalis* Andrássy, 2009 and *A. amazonicus* (Andrássy, 2004) Andrássy, 2009. However, it differs from both of them by having an only slightly offset head, characteristically divergent vulval lips and a longer tail (c' = 1.0–1.1 in *altitudinalis,* and 1.0–1.5 in *amazonicus*). Furthermore, it differs from both of them by the following characters. From *A. altitudinalis* by the smaller body (1.3–1.4 *vs*. 1.9–2.3 mm), narrower head (14 *vs*. 18–19 µm), and by the shorter odontostyle (18–20 *vs*. 23–24 µm). From *A. amazonicus* by the shorter body (1.3–1.4 *vs*. 1.6–1.7 mm), the more posteriorly located vulva (51–54 *vs*. 44–49 %), and by the long genital tract.

Type specimens. Holotype female on slide No. 14985. Paratypes: four females and two juveniles; all in the collection of the author.

Type habitat and locality. Humus with fallen leaves from a rain forest, 2000 m above sea level, near the village Baeza, Prov. Napo, Ecuador; collected in November 1971 by J. Balogh.

Etymology. Latin *decimus* means: tenth; this is the tenth known species of the genus *Aporcelinus.*

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Checklist of the Crustacea (Cladocera, Ostracoda, Copepoda) fauna in the active floodplain area of the Danube (1843-1806, 1669 and 1437-1489 rkm)

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Abstract. A checklist of Crustacea containing 90 taxa from the main arm and the active floodplain of the River Danube is given. Nine Cladocera species (*Anchistropus emarginatus*, *Daphnia ambigua*, *Holopedium gibberum*, *Monospilus dispar*, *Pleuroxus uncinatus* var. *balatonicus*, *Pseudochydorus globosus*, *Scapholeberis rammneri*, *Wlassicsia pannonica*) and two Copepoda species (*Cyclops insignis*, *Cyclops scutifer*) are new and rare species of the sampling area. The Ostracoda fauna of this region was nearly entirely undiscovered, 15 species were recorded. Among them *Bradleycypris obliqua*, *Bradleystrandesia reticulata*, *Paracandona euplectella* and *Prionocypris zenkeri* are rare species in Hungary.

INTRODUCTION

Following checklist is a result of a long-term (1999–2008) zooplankton investigation concentrating on three parts of the Hungarian Danube section: Szigetköz (1843–1806 rkm), Göd (1669 rkm) and Gemenc (1437–1489 rkm) in the main-arm and the active floodplain. The whole Hungarian section of the Danube is part of the Middle Danube Basin which covers a large area reaching from the Gate of Devin near Bratislava to the Iron Gate between Serbia and Romania. Unique side branch systems, oxbows, marshes, and large floodplain forests enrich the natural value of this stretch.

In the Szigetköz Area (1850–1793 rkm) intensive hydrobiological investigations were started in 1989 by the Hungarian Danube Research Station in order to monitor the environmental impacts of river regulation (Bothár 1968, 1985, 1988, Bothár & Ráth 1994, Kiss 2004, 2007, etc.). In the 1990s significant hydrological and morphological changes occurred on the Szigetköz Danube stretch mainly due to the construction of the Dunakiliti water reservoir and the regulation of the river. The active connection between the abandoned Danube stretch and the side-arm system in the floodplain disappeared and the water supply of the protected floodplain was materialized through the artificial water recharge system. Consequently, the artificial water recharge system, the water flow and the connection with the main river have become permanent in most of the side arms while individual characteristics, special phytoplankton and zooplankton assemblages are disappearing (Bothár 1998, Gulyás 1994, Kiss 2004).

The zooplankton investigations in the Hungarian Danube Research Station at Göd (GOD - 1669 rkm) started in 1965 (Bothár 1972, 1975, 1985, 1994, etc.) and altogether 76 taxa were recorded.

The Gemenc floodplain (1497–1467 rkm) is one of the last remaining extensive inundated floodplains of the Danube. The floodplain (30 km long and 5–10 km wide) is one of the largest in Europe with an area of 18,000 hectares (Natura, 2000). The Gemenc floodplain together with the Béda-Karapancsa (Gemenc-Béda-Karapancsa wetlands) represents an exceptional example of a large old floodplain with big meanders, oxbow lakes, marshlands and extended hardwood forests. Due to the river regulation in the 19th century, this area changed, the floodplain remained more or less isolated from the main stream, the length of the side arms decreased and a drying-out process was being observed during the 20th century. The

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most important human impacts, which changed the hydrological condition of the floodplain, were formerly the building-up of the drainage canals ("fok-system") and later the river regulations for flood control and navigation.

In 2002 a detailed investigation started in the floodplain, which incorporated water-chemical, algological, zooplankton and fish studies to monitor the actual condition of the floodplain and examine the river-floodplain relationships (Schöll *et al*. 2006, Schöll, Dinka & Kiss 2008, Schöll *et al*. 2008 etc.). The zooplankton studies compared with former investigations (e.g. Bothár 1979, 1981, Csányi *et. al*., 1994) examine different water bodies (side arms, dead arms, channels) and various hydrobiological situations (low, median and high water) (Kiss 2006, 2007, Kiss & Schöll 2009, Schöll & Kiss 2008).

MATERIALS AND METHODS

In the Szigetköz and the main arm at Göd (GOD - 1669 rkm) sampling has been carried out 3 or 4 times a year (usually May, July, August and October) since 1999 up to the present. Since 2001 in the Gemenc area sampling has been taken usually 4 or 5 times a year, but the number of sampling sites vary according to their hydrological situation.

Crustaceans were collected with plankton net (mesh size 70 μm) by filtering 100 or 50 litres of water then preserved in 4% formalin. Microcrustaceans were enumerated by using inverted microscopy and were identified at species level. Very dense samples were subsampled. Gulyás and Forró (1999, 2001), Meisch (2000) and the nomenclature of Dussart (1967, 1969) were used for species identification.

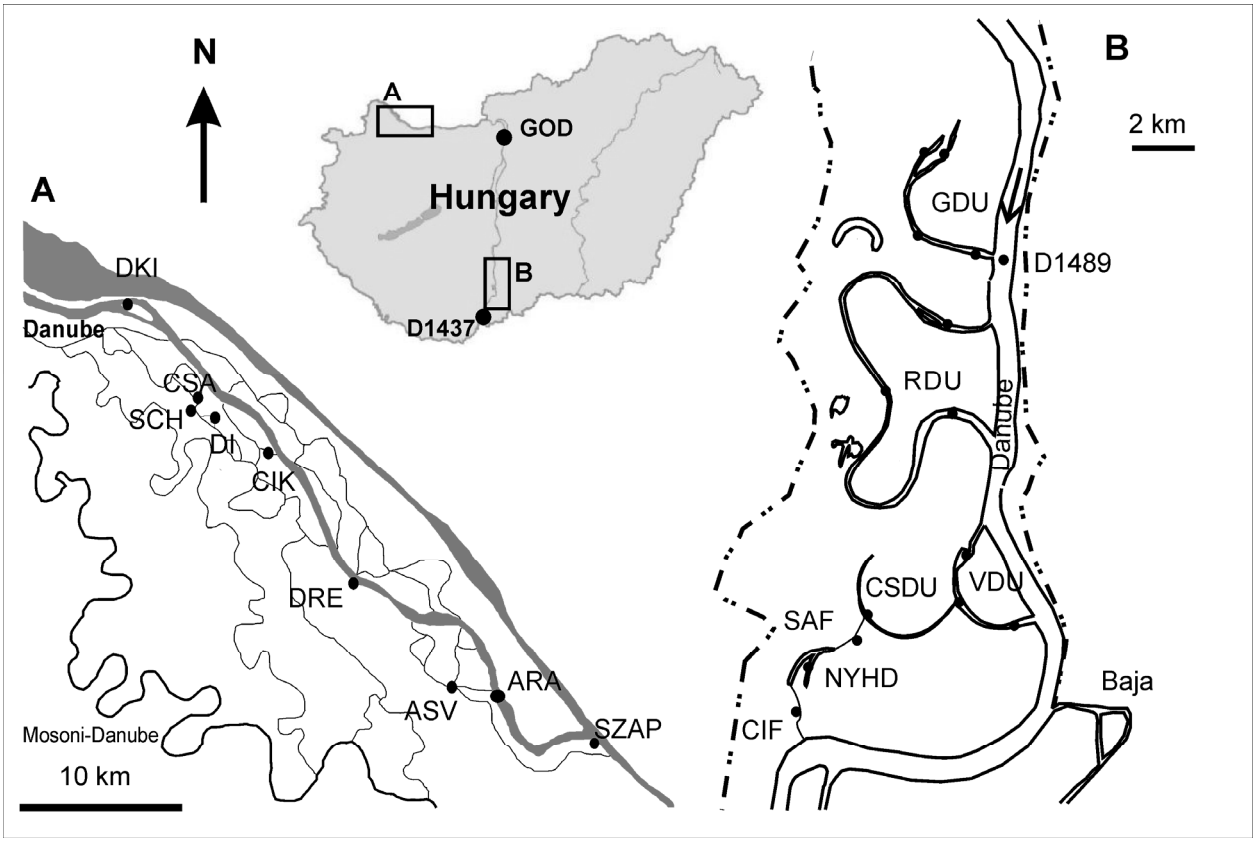

Figure 1. The sampling sites along the Hungarian section of the Danube. A: Szigetköz floodplain; B: Gemenc floodplain

THE SAMPLING SITES WITH THE GPS COORDINATES AND SAMPLING DATES

1. Main arm of the Danube (Fig. 1 A)

1843 rkm, Dunakiliti (DKI) N47° 59,738', E17° 18,927'. – The direct action site of the river bottom ramp. The sampling site is directly situated above the river bottom tramp.

1999 (09. 06., 14. 07., 01. 09., 28. 10.), 2000 (04. 07., 23. 08., 18. 10.), 2001 (10. 04., 04. 07., 04. 09., 11. 10), 2002 (12. 06., 10. 07., 18. 09., 08. 10.), 2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 13. 10.), 2005 (12. 07., 28. 09.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

1825 rkm, Dunaremete (DRE) N47°52,993' E17°27,404'. – Approximately 350 meter wide regulated bed, with rip-raps. The average flow velocity of the water is 1.9–2.2 m sec $^{-1}$. The level of the water is permanently lower than 1% (30–60 cm) since the diversion of the Danube.

2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 13. 10.), 2005 (12. 07., 28. 09.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

1816 rkm, Ásványráró (ARA) N47°45,889' E17°30,507'. – The lower end of the branch system of Ásványráró. Deep and dredging river section because of the navigation.

1999 (09. 06., 14. 07., 01. 09., 28. 10.), 2000 (04. 07., 23. 08., 18. 10.), 2001 (10. 04., 04. 07., 04. 09., 11. 10), 2002 (12. 06., 10. 07., 18. 09., 08. 10.), 2004 (24. 06., 16. 08., 13. 10.), 2005 (12. 07., 28. 09.).

1811 rkm, Szap (SZAP) N47°49,290' E17°-36,391'. – Deep (7–8 m) dredging river section because of the navigation. Rip-raps on the riverbank with breakwater on the right bank of the river.

1999 (09. 06., 14. 07., 01. 09., 28. 10.), 2000 (04. 07., 23. 08., 18. 10.), 2001 (10. 04., 04. 07., 04. 09., 11. 10), 2002 (12. 06., 10. 07., 18. 09., 08. 10.), 2004 (24. 06., 16. 08., 13. 10.).

1806 rkm, Medve at the bridge (MED) N47°25,433' E17°08,137'. – The site is situated below the bridgehead on the right bank of the Danube.

2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

1669 rkm, Göd (GOD) N47°40,816' E19°-07,543'. – The average wide of the Danube at Göd is 450 m, the average depth is 4.5 m. The substratum of the riverbed is small gravelly. The coast-defence with rip-raps. The flow velocity at median water is 1–1.2 m sec^{-1}.

1999 (09. 06., 14. 07., 01. 09., 28. 10.), 2000 (04. 07., 23. 08., 18. 10.), 2001 (10. 04., 04. 07., 04. 09., 11. 10), 2002 (12. 06., 10. 07., 18. 09., 08. 10.), 2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 13. 10.), 2005 (12. 07., 28. 09.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

1489 rkm, Érsekcsanád (D1489) N46° 16,403' E18° 54,547'. – In front of the mouth of Grébeci-Holt-Duna. Flow velocity at medium water 0.8-1.2 m sec^{-1}.

2002 (08. 04., 03. 07.), 2003 (07. 05., 08. 07., 15. 09. 27. 10.), 2004 (04. 14., 27. 05., 01. 07., 26. 08., 27. 10.), 2007 (23. 05., 11. 09., 25. 09.).

1437 rkm, Mohács (D1437) N45º55,967' E18º 46,433'. – Beyond the harbour of the ferry.

2007 (25. 07., 29. 08., 25. 10.), 2008 (18. 03., 10. 06.).

2. Szigetköz floodplain (Fig. 1 A)

Schisler-holtág /Schisler-oxbow/ (SCH) N47° 57,260' E17°21,640'. – Approximately 500 m long and 40–50 m wide stagnant water side-arm relic with plesiopotamal characteristics. Until the diversion of the Danube the water supply of the oxbow was during the higher floods alone. In autumn of 1992 the connection of the oxbow with the arms of the active floodplain was broken because of the water level depression of the side-arms. Following this only leaking water received particularly from the direction of the Zátonyi-Duna. In 1997 in the frame of habitat reconstruction project direct connection was established with the Csákányi-Duna through a channel.

1999 (09. 06., 14. 07., 01. 09., 28. 10.), 2000 (04. 07., 23. 08., 18. 10.), 2001 (10. 04., 04. 07., 04. 09., 11. 10), 2002 (12. 06., 10. 07., 18. 09., 08. 10.), 2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 14. 09., 13. 10.), 2005 (12. 07., 28. 09., 13. 10.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

Csákányi-Duna (CSA) N47°57,333' E17° 21,-636'. – The most widest and open water arm of the Cikolai branch system. Before the diversion of the Danube at median water was characterised by 1–3 m water depth, moderate water flow and gravel bed. After the diversion of the Danube in 1992 this section was nearly completely dried. Presently the water supply of the Csákányi-Duna is realized by the Kormosi side-arm and Dobor-gazi closure.

1999 (09. 06., 14. 07., 01. 09., 28. 10.), 2000 (04. 07., 23. 08., 18. 10.), 2001 (10. 04., 04. 07., 04. 09., 11. 10), 2002 (12. 06., 10. 07., 18. 09., 08. 10.), 2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 14. 09., 13. 10.), 2005 (12. 07., 28. 09., 13. 10), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

Cikolai-ág /Cikolai-arm/ (CIK) N47°55,964' E17°24,452'. – Nearly 120–150 m wide branch stretch with moderate water flow. This side-arm is the section of the Cikolai branch-system was locked up by cut-off. The water level is higher by several meters than the lower side of the closure.

2005 (12. 07., 28. 09.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.).

Disznós-ág /Disznós-arm/ (DI) N47°57,050' E17°22,056'. – Side-arm with parapotamal characteristics in the upper part of the Cikolai-branch system.

2004 (14. 09.), 2005 (13. 10.).

Ásványi-Duna (ASV) N47°50,314' E18° 31,-243'. – 1–3 m depth, gravel-bed and permanent flowing branch stretch along the Árvai closure.

1999 (09. 06., 14. 07., 01. 09., 28. 10.), 2000 (04. 07., 23. 08., 18. 10.), 2001 (10. 04., 04. 07., 04. 09., 11. 10), 2002 (12. 06., 10. 07., 18. 09., 08. 10.), 2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 13. 10.), 2005 (12. 07., 28. 09.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.).

3. Gemenc floodplain (Fig. 1 B)

Grébeci-Duna (GDU) N46°17,202' E18° 52,-921'. – Side arm with plesiopotamal characteristics, it was the part of the main arm until the interception in 1895-1896.

2002 (08. 04., 02. 05., 13. 06., 03. 07., 12. 11.), 2003 (07. 05., 08. 07., 15. 09. 27. 10.), 2004 (04. 14., 27. 05., 01. 07., 26. 08., 27. 10.), 2007 (23. 05., 11. 09., 25. 09.).

Rezéti-Duna (RDU) N46°14,767' E18°52,541'. Parapotamal side-arm, one time it was the main arm until the interception in 1893-1894.

2002 (08. 04., 02. 05., 13. 06., 03. 07., 12. 11.), 2003 (07. 05., 08. 07., 15. 09. 27. 10.), 2004 (04. 14., 27. 05., 01. 07., 26. 08., 27. 10.), 2007 (23. 05., 11. 09., 25. 09.).

Vén-Duna (VDU) N46°12,118' E18°53,843'. – Parapotamal side arm, it was the part of the main arm until the interception in 1897–1898.

2002 (08. 04., 02. 05., 13. 06., 03. 07., 12. 11.), 2003 (07. 05., 08. 07., 15. 09. 27. 10.), 2004 (04. 14., 27. 05., 01. 07., 26. 08., 27. 10.), 2007 (23. 05., 11. 09., 25. 09.).

Nyéki-Holt-Duna (NYHD) N46°11,355' E18° 50,749'. – Paleopotamal oxbow with dense macrovegetation.

2003 (07. 05., 08. 07., 15. 09.), 2004 (27. 05., 01. 07.),

Cserta-Duna (CSDU) N46°11,783' E18° 53-053'. – Plesiopotamal side arm of the Vén-Duna (VDU).

2003 (07. 05., 27. 10.), 2007 (25. 09.)

Sárkány-fok (SAF) N46°11,816' E18°51,594'. – Narrow channel between the NYHD and the Cserta-Duna.

2003 (07. 05., 08. 07., 15. 09.),

Címer-fok (CIF) N46°46,781' E18°50,723'. – Narrow channel between the NYHD and the main arm of the Danube

2003 (07. 05.)

4. Béda-Karapancsa floodplain

Külső-Béda (BDU) N45º55,767' E18º45,420'. – Plesiopotamal side arm.

2007 (25. 07., 29. 08., 25. 10.), 2008 (18. 03., 10. 06.).

RESULTS

Cladocera

Acroperus harpae (Baird, 1834)

Main arm: DKI 11.10.2001., 24.06.2004., 13.10.2004., DRE 13.10.2004., 07.07.2008. **Szigetköz floodplain:** SCH 11.10.2001., 14.09.2004., 28.09.2005., CSA 11.10.2001., 18.09.2002., 13.05.2003., ASV 13.10.2004., DI 14. 09. 2004.

Gemenc floodplain: NYHD 05. 07. 2003., CSDU 05. 07. 2003., 27. 10. 2003., 25. 09. 2007.

Alona affinis (Leydig, 1860)

Main arm: DKI 10.04.2001., 24.06.2004., ARA 14.07. 1999., SZAP 14.07.1999., 01.09.1999. **Szigetköz floodplain:** SCH 23.08. 2000., 24.06.2004., ASV 24.06.2004., DI 14. 09.2004., GOD 09.06.1999. **Gemenc floodplain:** RDU 27.10.2004., 23.05.2007.

Alona costata Sars, 1862

Main arm: DKI 30.10.2003., 04.07.2006., 20.05.2008., 07.07.2008., DRE 13.10.2004., 07.07.2008., SZAP 13.10. 2004., MED 16.10.2007., 07.07.2008., GOD 04.09.2001., 18. 09.2002., 16.10.2007., D1437 18.03.2008. **Szigetköz floodplain:** SCH 04.07.2000., 24.06.2004., 14.09.2004., 13.10. 2005., 04.07.2006., 26.09.2006., 20.05.2008., CSA 18.09. 2002., 12.07.2005., 28.09.2005., 13.10.2005., 20.05.2008., 07.07.2008., ASV 13.10.2004., 26.09.2006. **Gemenc floodplain:** GDU 23.05.2007., NYHD 07.05.2003., CSDU 27.10. 2003.

Alona guttata Sars, 1862

Main arm: DKI 04.07.2006., 09.07.2006., DRE 07.07.2008, D1437 29.08.2007., 25.10.2007. **Szigetköz floodplain:** SCH 14.09.2004., ASV 08.10.2002. **Gemenc floodplain:** GDU 06.05.2003. **Béda-Karapancsa floodplain:** BDU 25.10. 2007.

Alona intermedia Sars, 1862

Main arm: DKI 08.10.2002., GOD 07.07.2008., D1489 27.05.2004. **Szigetköz floodplain:** SCH 23.08.2000., 04.07.2001., 11.06.2002., 14.09.2004., CSA 10.04.2001., 04.07.2001., 11.10.2001., 13.05.2003., 24.06.2004., 14.09. 2004., ASV 10.07.2002., 24.06.2004. **Gemenc floodplain:** GDU 23.05.2007., 25.09.2007., RDU 08.04.2002., 15.09. 2003., 27.10.2003., 27.05.2004., 25.09.2007., VDU 03.07. 2002., 15.09.2003., 14.04.2004., NYHD 08.07.2003., 27.05. 2003., CIF 07.05.2003.

Alona quadrangularis (O. F. Müller, 1785)

Main arm: DKI 11.06.2002., 17.04.2007., 07.07.2008., DRE 13.05.2003., 20.05.2008., MED 07.07.2008., GOD 04.07.2000. **Szigetköz floodplain:** ASV 28.10.1999., 11.06. 2002., 13.05.2003. **Gemenc floodplain:** RDU 03.07.2002., 12.11.2002., 15.09.2003., 01.07.2004., VDU 13.06.2002., 03.07.2002., 08.07.2003., CSDU 25.09.2007.

Alona rectangula Sars, 1862

Main arm: GOD 01.09.1999. **Gemenc floodplain:** NYHD 07.05.2003. **Béda-Karapancsa floodplain:** BDU 25.10.2007.

Alonella excisa (Fischer, 1854)

Szigetköz floodplain: SCH 24.06.2004., 14.09.2004., DI 14.09.2004. **Gemenc floodplain:** CSDU 07.05.2003.

Alonella nana (Baird, 1850)

Main arm: DKI 13.10.2004., 26.09.2006., 07.07.2008., DRE 13.10.2004., 20.05.2008., 07.07.2008., MED 07.07. 2008., GOD 28.10.1999. **Szigetköz floodplain:** SCH 04.07. 2000., 10.04.2001., 10.09.2003., 14.09.2004., 28.09.2005., 13.10.2005., CSA 18.10.2000., 14.09.2004., 13.10.2004., 17.04.2007., ASV 14.07.1999., 13.05.2003., 17.04.2007., CIK 17.04.2007. **Gemenc floodplain:** RDU 08.04.2002., 12.11.2002., NYHD 07.05.2003., CSDU 27.10.2003., SAF 15.09.2003.

Anchistropus emarginatus Sars, 1862

Szigetköz floodplain: SCH 04.07.2006.

Bosmina coregoni (Baird, 1857)

Gemenc floodplain: GDU 11.09.2007., VDU 15.09. 2003.

Bosmina longispina Leydig, 1860

Main arm: SZAP 04.07.2000. **Gemenc floodplain:** VDU 08.04.2002., 01.07.2004.

Bosmina longirostris (O. F. Müller, 1785)

Main arm: DKI 09.06.1999., 14.07.1999., 04.07.2000., 10.04.2001., 04.07.2001., 04.09.2001., 12.06.2002., 18.09. 2002., 08.10.2002., 13.05.2003., 22.07.2003., 10.09.2003., 24.06.2004., 28.09.2005., 04.07.2006., 26.09.2006., 17.04 2007., 16.10.2007., DRE 13.05.2003., 22.07.2003., 10.09. 2003., ARA 09.06.1999., 14.07.1999., 01.09.1999., 28.10. 1999., 04.07.2000., 12.06.2002., 08.10.2002., 16.08.2004., SZAP 09.06.1999., 14.07.1999., 28.10.1999., 04.07.2000., 18.10.2000., 10.04.2001., 04.07.2001., 04.09.2001., 12.06. 2002., 08.10.2002., 13.10.2004., MED 04.07.2006., 17.04. 2007., 20.05.2008., GOD 09.06.1999., 14.07.1999., 01.09. 1999., 28.10.1999., 04.07.2000., 04.09.2001., 18.09.2002., 13.05.2003., 20.05.2008., 07.07.2008., D1489 08.04.2002., 03.07.2002., 07.05.2003., 15.09.2003., 27.10.2003., 14.04. 2004., 27.05.2004., 01.07.2004., 23.05.2007., D1437 25.07. 2007., 29.08.2007., 25.10.2007. **Szigetköz floodplain:** SCH 09.06.1999., 14.07.1999., 01.09.1999., 28.10.1999., 04.07. 2000., 23.08.2000., 04.07.2001., 04.09.2001., 11.10.2001., 12.06.2002., 10.07.2002., 18.09.2002., 08.10.2002., 13.05. 2003., 22.07.2003., 10.09.2003., 30.10.2003., 16.08.2004., 14.09.2004., 13.10.2004., 28.09.2005., 13.10.2005., 04.07. 2006., 26.09.2006., 17.04.2007., 09.07.2007., 16.10.2007., 20.05.2008., 07.07.2008., CSA 14.07.1999., 18.10.2000., 04. 09.2001., 12.06.2002., 13.05.2003., 22.07.2003., 13.10. 2005., 17.04.2007., 20.05.2008., ASV 09.06.1999., 14.07. 1999., 01.09.1999., 28.10.1999., 12.06.2002., 08.10.2002.,

13.05.2003., 10.09.2003., 04.07.2006., 26.09.2006., CIK 26.09.2006., DI 14.09.2004. **Gemenc floodplain:** GDU 08. 04.2002., 02.05.2002., 13.06.2002., 03.07.2002., 12.11. 2002., 07.05.2003., 15.09.2003., 14.04.2004., 27.05.2004., 01.07.2004., 27.10.2004., 23.05.2007., 25.09.2007., RDU 08.04.2002., 02.05.2002., 13.06.2002., 12.11.2002., 07.05. 2003., 08.07.2003., 15.09.2003., 27.10.2003., 14.04.2004., 27.05.2004., 01.07.2004., 26.08.2004., 27.10.2004., 23.05. 2007., 11.09.2007., 25.09.2007., VDU 08.04.2002., 13.06. 2002., 12.11.2002., 07.05.2003., 15.09.2003., 27.10.2003., 14.04.2004., 27.05.2004., 01.07.2004., 26.08.2004., 27.10. 2004., 23.05.2007., 11.09.2007., 25.09.2007., NYHD 07.05. 2003., 27.05.2004., CSDU 07.05.2003., 27.10.2003., 25.09. 2007. **Béda-Karapancsa floodplain:** BDU 25.10.2007., 18. 03.2008., 10.06.2008.

Camptocercus lilljeborgi Schoedler, 1862

Main arm: ARA 14.07.1999. **Szigetköz floodplain:** SCH 04.09.2001., CSA 04.09.2001.

Camptocercus rectirostris Schoedler, 1862

Szigetköz floodplain: SCH 04.09.2001., CSA 04.09. 2001.

Ceriodaphnia laticaudata P. E. Müller, 1867

Main arm: D1489 26.08.2004. **Gemenc floodplain:** CSDU 07.05.2003. **Béda-Karapancsa floodplain:** BDU 10.06. 2008.

Ceriodaphnia megops Sars, 1862

Gemenc floodplain: SAF 08.07.2003., CIF 07.05.2003.

Ceriodaphnia pulchella Sars, 1862

Main arm: DKI 09.06.1999., 28.09.2005., ARA 09.06.1999., GOD 28.10.1999. **Szigetköz floodplain:** SCH 14.07.1999., 28.10.1999., 14.09.2004., 28.09.2005., 13.10. 2005., 04.07.2006., 16.10.2007., CSA 04.09.2001., ASV 09.06.1999.

Ceriodaphnia quadrangula (O. F. Müller, 1785)

Main arm: DKI 04.07.2000., 04.07.2001., 04.09.2001., 12.06.2002., 22.07.2003., DRE 07.07.2008., ARA 16.08. 2004., SZAP 04.07.2000., MED 07.07.2008., D1489 26. 08.2004. **Szigetköz floodplain:** SCH 04.07.2000., 04.07. 2001., 04.09.2001., 12.06.2002., 10.07.2002., 08.10.2002., 13.05.2003., 16.08.2004., 14.09.2004. 13.10.2004., 20.05. 2008., 07.07.2008., ASV 24.06.2004., 16.08.2004., 13.10. 2004., 04.07.2006. **Gemenc floodplain:** GDU 27.05.2004., 01.07.2004., VDU 27.05.2004., NYHD 07.05.2003., CSDU 27.10. 2003.

Ceriodaphnia reticulata (Jurine, 1820)

Szigetköz floodplain: SCH 24.06.2004., 17.04.2007. **Gemenc floodplain:** GDU 27.05.2004., 23.05.2007., NYHD 07.05.2003., 08.07.2003., SAF 08.07.2003., 15.09.2003., CIF 07.05.2003. **Béda-Karapancsa floodplain:** BDU 25.10. 2007.

Chydorus gibbus Sars, 1890

Szigetköz floodplain: ASV 09.06.1999.

Chydorus ovalis Kurz, 1875

Szigetköz floodplain: SCH 28.10.1999.

Chydorus piger Sars, 1862

Szigetköz floodplain: SCH 23.08.2000.

Chydorus sphaericus (O. F. Müller, 1776)

Main arm: DKI 09.06.1999., 28.10.1999., 04.07.2001., 12.06.2002., 22.07.2003., 10.09.2003., 24.06.2004., 04.07. 2006., 17.04.2007., 09.07.2007., 16.10.2007., 07.07.2008., DRE 10.09.2003., 12.07.2005., 17.04.2007., 09.07.2007., 16.10.2007., 20.05.2008., 07.07.2008., 08.10.2008., ARA 09. 06.1999., 14.07.1999., 28.10.1999., 11.10.2001., 12.06. 2002., 10.07.2002., SZAP 18.10.2000., 12.06.2002., 08.10. 2002., MED 09.07.2007., GOD 09.06.1999., 13.05.2003., 17.04.2007., 20.05.2008., D1489 07.05.2003., 15.09.2003., 14.04.2004., 27.05.2004., 23.05.2007., 25.09.2007., D1437 25.10.2007., 18.03.2008. **Szigetköz floodplain:** SCH 28.10. 1999., 10.04.2001., 04.07.2001., 11.10.2001., 12.06.2002., 10.07.2002., 13.05.2003., 30.10.2003., 24.06.2004., 14.09. 2004., 13.10.2004., 28.09.2005., 13.10.2005., 04.07.2006., 20.05.2008., 07.07.2008., 08.10.2008., CSA 09.06.1999., 14.07.1999., 10.04.2001., 04.07.2001., 11.10.2001., 12.06. 2002., 18.09.2002., 08.10.2002., 13.05.2003., 22.07.2003., 24.06.2004., 16.08.2004., 14.09.2004., 12.07.2005., 28.09. 2005., 13.10.2005., 26.09.2006., 17.04.2007., 20.05.2008., 07.07.2008., 08.10.2008., ASV 09.06.1999., 14.07.1999., 28. 10.1999., 12.06.2002., 13.05.2003., 10.09.2003., 24.06. 2004., 16.08.2004., 13.10.2004., 12.07.2005., 26.09.2006., 17.04.2007., 09.07.2007., CIK 17.04.2007., DI 14.09.2004., 13.10. 2005. **Gemenc floodplain:** GDU 02.05.2002., 13.06. 2002., 12.11.2002., 07.05.2003., 15.09.2003., 14.04.2004., 27.05.2004., 01.07.2004., 23.05.2007., 25.09.2007., RDU 08.04.2002., 02.05.2002., 13.06.2002., 12.11.2002., 07.05. 2003., 15.09.2003., 27.10.2003., 14.04.2004., 27.05.2004., 01.07.2004., 27.10.2004., 23.05.2007., 11.09.2007., 25.09. 2007., VDU 02.05.2002., 13.06.2002., 07.05.2003., 08.07. 2003., 15.09.2003., 27.10.2003., 14.04.2004., 27.05.2004., 01.07.2004., 23.05.2007., 11.09.2007., NYHD 07.05.2003., 08.07.2003., 27.05.2004., 01.07.2004., CSDU 07.05.2003., 27.10.2003., 25.09.2007., SAF 07.05.2003., 08.07.2003., 15. 09.2003., CIF 07.05.2003. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 25.10.2007., 18.03.2008., 10.06.2008.

Daphnia ambigua Scourfield, 1946

Szigetköz floodplain: SCH 04.07.2006.

Daphnia cucullata Sars, 1862

Main arm: DKI 04.07.2000., 04.07.2001., 12.06.2002., DRE 22.07.2003., SZAP 18.10.2000., 04.07.2001., GOD 13.05.2003., 22.07.2003., D1489 08.04.2002., 27.05.2004., D1437 29.08.2007. **Szigetköz floodplain:** SCH 04.07.2000., 23.08.2000., 04.07.2001., 04.09.2001., 10.07.2002., 16.08. 2004., 14.09.2004., 13.10.2005., 04.07.2006., 26.09.2006., 17.04.2007., CSA 13.05.2003., ASV 04.07.2006. **Gemenc floodplain:** GDU 02.05.2002., 13.06.2002., 07.05.2003., 27.05.2004., 01.07.2004., 23.05.2007., 25.09.2007., RDU 27.10.2003., VDU 08.04.2002., 07.05.2003., 07.05.2003., 11. 09.2007. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 29.08.2007., 25.10.2007., 18.03.2008., 10.06.2008.

Daphnia hyalina Leydig, 1860

Main arm: DKI 09.06.1999., 14.07.1999., 04.07.2006., SZAP 09.06.1999. **Szigetköz floodplain:** SCH 09.06.1999., 01.09.1999. **Gemenc floodplain:** VDU 15.09.2003., 27.05. 2004.

Daphnia longispina O. F. Müller, 1785

Main arm: DKI 09.06.1999., 01.09.1999., ARA 28.10. 1999., SZAP 09.06.1999., 14.07.1999., D1489 08.04.2002., 27.05.2004., 11.09.2007., D1437 25.10.2007. **Szigetköz floodplain:** SCH 28.10.1999. **Gemenc floodplain:** GDU 27.05.2004., 23.05.2007., RDU 12.11.2002., CIF 07.05.2003. **Béda-Karapancsa floodplain:** BDU 25.10.2007.

Diaphanosoma brachyurum (Liévin, 1848)

Main arm: DKI 04.07.2001., GOD 04.07.2000., D1489 08.07.2003. **Szigetköz floodplain:** SCH 09.06.1999., 04.07. 2000., 23.08.2000., 12.06.2002., 10.07.2002., 18.09.2002., 08.10.2002., 13.05.2003., 22.07.2003., 10.09.2003., 14.09. 2004., 13.10.2004., 28.09.2005., 13.10.2005., 04.07.2006., CSA 09.06.1999. **Gemenc floodplain:** GDU 01.07.2004., 23.05.2007., RDU 13.06.2002., 03.07.2002., 08.07.2003., 26. 08.2004., VDU 03.07.2002., 15.09.2003., 26.08.2004. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 29.08.2007., 10.06.2008.

Disparalona rostrata (Koch, 1841)

Main arm: DKI 04.07.2000., 08.10.2002., 17.04.2007., DRE 17.04.2007., ARA 01.09.1999., 12.06.2002., SZAP 12. 06.2002., GOD 22.07.2003., 16.08.2004., D1489 03.07. 2002., 15.09.2003., 26.08.2004., D1437 10.06.2008. **Szigetköz floodplain:** SCH 18.10.2000., 28.09.2005., CSA 11. 10.2001., 13.05.2003., 14.09.2004., 17.04.2007., ASV 04.07.2000., 26.09.2006., 17.04.2007., CIK 17.04.2007., DI 14.09.2004. **Gemenc floodplain:** GDU 03.07.2002., 23.05. 2007., RDU 13.06.2002., 03.07.2002., 12.11.2002., 07.05. 2003., 15.09.2003., 14.04.2004., 27.10.2004., 23.05.2007., VDU 13.06.2002., 03.07.2002., 08.07.2003., 27.10.2003., 26. 08.2004., 27.10.2004., 25.09.2007., SAF 08.07.2003. **Béda-Karapancsa floodplain:** BDU 25.10.2007.

Eurycercus lamellatus (O. F. Müller, 1785)

Szigetköz floodplain: SCH 09.07.2007., ASV 28.10. 1999., 09.07.2007.

Graptoleberis testudinaria (Fischer, 1848)

Main arm: DKI 04.07.2001., 04.09.2001., 13.10.2004., 04.07.2006., DRE 13.10.2004., 07.07.2008., SZAP 13.10. 2004. **Szigetköz floodplain:** SCH 04.07.2001., 14.09.2004., 04.07.2006., 26.09.2006., CSA 04.07.2001., 11.10.2001., 10.09.2003., 24.06.2004., 16.08.2004., 14.09.2004., 13.10. 2004., 28.09.2005., 26.09.2006., ASV 28.10.1999., 13.10. 2004., DI 14.09.2004. **Gemenc floodplain:** GDU 07.05. 2003., NYHD 07.05.2003.

Holopedium gibberum Zaddach, 1855

Szigetköz floodplain: SCH 16.08.2004., 13.10.2004.

Iliocryptus agilis Kurz, 1878

Main arm: DKI 17.04.2007., DRE 13.05.2003., ARA 28.10.1999., MED 20.05.2008., GOD 04.09.2001., 18.09. 2002., 17.04.2007. **Szigetköz floodplain:** SCH 28.09.2005., CSA 13.05.2003., 09.07.2007., CIK 04.07.2006. **Gemenc floodplain:** GDU 27.05.2004., 27.10.2004., RDU 14.04. 2004., 01.07.2004., 26.08.2004., 25.09.2007., VDU 03.07. 2002., 08.07.2003., 01.07.2004., 23.05.2007., NYHD 15.09. 2003. **Béda-Karapancsa floodplain:** BDU 18.03.2008.

Iliocryptus sordidus (Liévin, 1848)

Main arm: DKI 14.07.1999. **Gemenc floodplain:** VDU 07.05.2003.

Leydigia leydigi (Schoedler, 1863)

Main arm: DKI 13.05.2003., GOD 04.09.2001., 18.09. 2002. **Gemenc floodplain:** VDU 08.07.2003.

Macrothrix hirsuticornis Norman & Brady, 1867

Main arm: DKI 14.07.1999., 13.05.2003., 24.06.2004., 20.05.2008., 07.07.2008., SZAP 10.04.2001., GOD 09.06. 1999., 20.05.2008. **Szigetköz floodplain:** CSA 10.04.2001., ASV 24.06.2004. **Gemenc floodplain:** RDU 02.05.2002., 01.07.2004., VDU 07.05.2003., 01.07.2004.

Macrothrix laticornis (Fischer, 1848)

Main arm: GOD 16.08.2004. **Szigetköz floodplain:** ASV 13.05.2003. **Gemenc floodplain:** RDU 15.09.2003., VDU 13.06.2002., 03.07.2002., 08.07.2003., 15.09.2003., 27.05. 2004., 26.08.2004.

Moina brachiata (Jurine, 1820)

Main arm: DKI 04.09.2001., 12.06.2002., 22.07.2003., SZAP 12.06.2002., 08.10.2002., GOD 04.07.2000., 04.09. 2001., 18.09.2002., D1489 03.07.2002., 08.07.2003., 26.08. 2004., D1437 29.08.2007. **Szigetköz floodplain:** SCH 14.07.1999., 01.09.1999., 04.07.2000., 23.08.2000., 04.07. 2001., 04.09.2001., 12.06.2002., 10.07.2002., 18.09.2002., 08.10.2002., 22.07.2003., 10.09.2003., 16.08.2004., 14.09. 2004., 13.10.2004., 26.09.2006., 07.07.2008. **Gemenc floodplain:** GDU 02.05.2002., 13.06.2002., 03.07.2002., 15.09. 2003., 27.05.2004., 01.07.2004., 25.09.2007., RDU 13.06. 2002., 03.07.2002., 08.07.2003., 15.09.2003., 26.08.2004., VDU 03.07.2002., 08.07.2003., 15.09.2003., 01.07.2004., 26.08.2004.

Monospilus dispar Sars, 1862

Main arm: DKI 08.10.2008. **Gemenc floodplain:** VDU 13.06.2002.

Pleuroxus aduncus (Jurine, 1820)

Main arm: DKI 23.08.2000., 04.07.2001., 12.06.2002., 24.06.2004., 04.07.2006., 07.07.2008., DRE 16.10.2007., 07.07.2008., ARA 14.07.1999., D1489 26.08.2004., 27.10. 2004. **Szigetköz floodplain:** SCH 04.07.2000., 23.08.2000., 11.10.2001., 24.06.2004., 14.09.2004., 13.10.2005., 04.07. 2006., 26.09.2006., 09.07.2007., CSA 18.10.2000., 04.09. 2001., 11.10.2001., 12.06.2002., 18.09.2002., 22.07.2003., 24.06.2004., ASV 30.10.2003., 26.09.2006., DI 14.09.2004., 13.10.2005. **Gemenc floodplain:** GDU 13.06.2002., VDU 01.07.2004., 26.08.2004., 25.09.2007., NYHD 07.05.2003., 08.07.2003., CSDU 07.05.2003., 27.10.2003., SAF 07.05. 2003., 08.07.2003., 15.09.2003., CIF 07.05.2003.

Pleuroxus denticulatus Birge, 1879

Main arm: DKI 24.06.2004., DRE 26.09.2006., 07.07.2008. **Szigetköz floodplain:** SCH 10.09.2003., 24.06. 2004., 14.09.2004., 26.09.2006., CSA 13.05.2003., 24.06. 2004., 26.09.2006., 07.07.2008., ASV 30.10.2003., 26.09. 2006., DI 14.09.2004., 13.10.2005. **Gemenc floodplain:** VDU 14.04. 2004., CSDU 27.10.2003., SAF 08.07.2003. **Béda-Karapancsa floodplain:** BDU 25.10.2007.

Pleuroxus truncatus (O. F. Müller, 1785)

Main arm: DKI 09.06.1999., 04.07.2001., 08.10.2002., 10.09.2003., 24.06.2004., 04.07.2006., 26.09.2006., DRE 16. 10.2007., 20.05.2008., 07.07.2008., ARA 28.10.1999., 16.08. 2004., SZAP 04.07.2001., 13.10.2004., GOD 14.07.1999., 28.10.1999., 04.07.2001., 10.07.2002., 09.07.2007. **Szigetköz floodplain:** SCH 09.06.1999., 28.10.1999., 04.07.2001., 11.10.2001., 12.06.2002., 10.07.2002., 13.10.2004., 13.10 2005., 04.07.2006., CSA 04.07.2001., 04.09.2001., 11.10. 2001., 18.09.2002., 22.07.2003., ASV 30.10.2003., 16.08. 2004., 26.09.2006., 16.10.2007., CIK 04.07.2006., 26.09. 2006. **Gemenc floodplain:** GDU 07.05.2003., RDU 25.09. 2007., VDU 27.10.2003., NYHD 07.05.2003., 01.07.2004., CSDU 27.10.2003., 25.09.2007.

Pleuroxus uncinatus Baird, 1850

Szigetköz floodplain: SCH 09.06.1999., 01.09.1999., 24.06.2004., 16.08.2004., 13.10.2005., CSA 24.06.2004., 16. 08.2004., ASV 14.07.1999.

Pleuroxus uncinatus v. *balatonicus* Daday, 1895

Gemenc floodplain: RDU 01.07.2004.

Polyphemus pediculus (Linné, 1761)

Main arm: DKI 09.07.2007. **Szigetköz floodplain:** SCH 08.10.2008.

Pseudochydorus globosus (Baird, 1843)

Szigetköz floodplain: SCH 24.06.2004.

Scapholeberis mucronata (O. F. Müller, 1785)

Main arm: DKI 24.06.2004., DRE 20.05.2008., GOD 09.06.1999., 20.05.2008., D1489 15.09.2003. **Szigetköz floodplain:** SCH 23.08.2000., 12.06.2002., 24.06.2004., 14.09.2004., 28.09.2005., CSA 24.06.2004., ASV 13.05. 2003., 16.08.2004., 12.07.2005., CIK 26.09.2006. **Gemenc floodplain:** GDU 07.05.2003., 01.07.2004., 23.05.2007., RDU 08.07.2003., 27.10.2004., 23.05.2007., 11.09.2007., 25. 09.2007., VDU 15.09.2003., 14.04.2004., 01.07.2004., NYHD 07.05.2003., 08.07.2003., 27.05.2004., CSDU 08. 07.2003., 27.10.2003., 25.09.2007., SAF 07.05.2003., 08.07. 2003., CIF 07.05.2003. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 10.06.2008.

Scapholeberis rammneri Dumont & Pensaert, 1983

Gemenc floodplain: RDU 25.09.2007.

Sida crystallina (O. F. Müller, 1776)

Main arm: DKI 04.07.2001., 24.06.2004., 04.07.2006., ARA 04.07.2000., 04.07.2001., SZAP 04.07.2001., GOD 28.10.1999., 04.09.2001., 18.09.2002. **Szigetköz floodplain:** SCH 28.10.1999., 04.07.2000., 04.07.2001., 04.09.2001., 12.06.2002., 10.07.2002., 13.05.2003., 14.09.2004., 08.10. 2008., CSA 04.07.2000., 04.07.2001., 04.09.2001., 11.10. 2001., 24.06.2004., 16.08.2004., 13.10.2005., 26.09.2006., ASV 04.09.2001., 26.09.2006., DI 14.09.2004., 13.10.2005. **Gemenc floodplain:** NYHD 07.05.2003.

Simocephalus exspinosus (Koch, 1841)

Szigetköz floodplain: SCH 20.05.2008.

Simocephalus serrulatus (Koch, 1841)

Szigetköz floodplain: SCH 04.07.2006.

Simocephalus vetulus (O. F. Müller, 1776)

Main arm: DKI 23.08.2000., 24.06.2004., DRE 20.05.2008., 07.07.2008., 08.10.2008., MED 17.04.2007. **Szigetköz floodplain:** SCH 24.06.2004., 14.09.2004., 28.09.2005., 04.07.2006., CSA 24.06.2004., ASV 01.09. 1999., 04.07.2000., 16.08.2004., 12.07.2005., 26.09.2006. **Gemenc floodplain:** RDU 27.05.2004., 01.07.2004., VDU 15.09.2003., NYHD 07.05.2003., 08.07.2003., 01.07.2004., CSDU 08.07.2003., 25.09.2007., SAF 07.05.2003., 08.07.-2003., 15.09.2003., CIF 07.05.2003.

Wlassicsia pannonica Daday, 1904

Main arm: DRE 08.10.2008.

Ostracoda

Bradleycypris obliqua (Brady, 1868)

Gemenc floodplain: SAF 15.09.2003.

Bradleystrandesia reticulata (Zaddach, 1844)

Gemenc floodplain: NYHD 07.05.2003., CIF 07.05. 2003.

Candona weltneri Hartwig, 1899

Gemenc floodplain: NYHD 07.05.2003.

Cyclocypris laevis (O. F. Müller, 1776)

Szigetköz floodplain: SCH 04.07.2006., CSA 24.06. 2004. **Gemenc floodplain:** RDU 27.05.2004.

Cyclocypris ovum (Jurine, 1820)

Main arm: DKI 12.07.2005. **Szigetköz floodplain:** ASV 12.07.2005. **Gemenc floodplain:** RDU 26.08.2004., VDU 14.04.2004.

Cypria ophtalmica (Jurine, 1820)

Main arm: DRE 17.04.2007., 20.05.2008., 07.07.2008., ARA 28.10.1999., 28.09.2005., SZAP 04.07.2001. **Szigetköz floodplain:** SCH 24.06.2004., CSA 18.09.2002., 16.08. 2004., ASV 17.04.2007., 09.07.2007. **Gemenc floodplain:** RDU 27.10.2004., 23.05.2007., NYHD 15.09.2003., CSDU 07.05.2003. **Béda-Karapancsa floodplain:** BDU 10.06. 2008.

Cypridopsis elongata (Kaufmann, 1900)

Szigetköz floodplain: SCH 11.10.2001., CSA 04.07. 2001., 04.09.2001., 11.10.2001.

Cypridopsis vidua (O. F. Müller, 1776)

Main arm: DKI 04.09.2001., 24.06.2004., 13.10.2004., 04.07.2006., DRE 07.07.2008. **Szigetköz floodplain:** SCH 24.06.2004., 14.09.2004., 28.09.2005., 04.07.2006., 26.09. 2006., 09.07.2007., CSA 24.06.2004., 16.08.2004., DI 14.09. 2004. **Gemenc floodplain:** GDU 15.09.2003., VDU 25.09. 2007., NYHD 07.05.2003., 08.07.2003., CSDU 07.05.2003., SAF 08.07.2003., CIF 07.05.2003.

Cypris pubera O. F. Müller, 1776

Gemenc floodplain: GDU 27.05.2004., RDU 27.05. 2004.

Limnocythere inopinata (Baird, 1843)

Main arm: DKI 12.06.2002., 08.10.2008., DRE 17.04. 2007., MED 04.07.2006. **Szigetköz floodplain:** SCH 12.06. 2002., 13.10.2005., 26.09.2006., 08.10.2008., CSA 14.09. 2004. **Gemenc floodplain:** RDU 11.09.2007.

Notodromas monacha (O. F. Müller, 1776)

Main arm: DKI 12.07.2005., D1489 26.08.2004.

Paracandona euplectella (Robertson, 1889)

Gemenc floodplain: NYHD 07.05.2003.

Physocypria kraepelini G. W. Müller, 1903

Gemenc floodplain: GDU 07.05.2003., RDU 07.05.2003., NYHD 07.05.2003., 08.07.2003., 15.09.2003., SAF 07.05.2003., 08.07.2003.

Prionocypris zenkeri (Chyzer & Toth, 1858)

Szigetköz floodplain: SCH 01.09.1999.

Pseudocandona compressa (Koch, 1838)

Gemenc floodplain: SAF 15.09.2003., CIF 07.05.2003.

Copepoda

Harpacticoida

Canthocamptus staphylinus (Jurine, 1820)

Main arm: DKI 10.04.2001., 26.09.2006., 17.04.2007., DRE 16.10.2007., 07.07.2008., 08.10.2008., SZAP 10.04. 2001., 11.10.2001., MED 07.07.2008., GOD 16.10.2007., 08. 10.2008. **Szigetköz floodplain:** SCH 10.04.2001., 14.09. 2004., CSA 10.04.2001., 14.09.2004., ASV 04.09.2001., 11.10.2001., 12.06.2002., 26.09.2006., 17.04.2007., CIK 17.04.2007., DI 14.09.2004. **Gemenc floodplain:** GDU 27. 05.2004., 11.09.2007., RDU 27.05.2004., CSDU 07.05. 2003., 27.10.2003., CIF 07.05.2003.

Calanoida

Eudiaptomus gracilis (Sars, 1863)

Main arm: DKI 04.07.2001., 04.09.2001., 11.10.2001., 22.07.2003., 10.09.2003., DRE 09.07.2007., ARA 09.06.

1999., 14.07.1999., 01.09.1999., 28.10.1999., SZAP 09.06. 1999., 01.09.1999., 28.10.1999., 04.09.2001., GOD 14.07. 1999., 20.05.2008., 08.10.2008., D1437 10.06.2008. **Szigetköz floodplain:** SCH 09.06.1999., 14.07.1999., 01.09.1999., 28.10.1999., 04.07.2000., 23.08.2000., 10.04.2001., 04.09. 2001., 11.10.2001., 12.06.2002., 10.07.2002., 18.09.2002., 08.10.2002., 13.05.2003., 10.09.2003., 30.10.2003., 14.09. 2004., 13.10.2004., 12.07.2005., 28.09.2005., 13.10.2005., 04.07.2006., 26.09.2006., 17.04.2007., 09.07.2007., 16.10. 2007., 20.05.2008., 07.07.2008., 08.10.2008., CSA 18.10. 2000., ASV 28.10.1999., DI 13.10.2005. **Gemenc floodplain:** GDU 08.04.2002., 02.05.2002., 13.06.2002., 07.05. 2003., 27.05.2004. **Béda-Karapancsa floodplain:** BDU 18.03.2008., 10.06.2008.

Eudiaptomus vulgaris (Schmeil, 1896)

Gemenc floodplain: RDU 14.04.2004., 11.09.2007., 25.09.2007., NYHD 07.05.2003.

Eurytemora velox (Lilljeborg, 1853)

Main arm: D1843: 04.07.2000., 13.05.2003., 30.10. 2003., 24.06.2004., 28.09.2005., 17.04.2007., D1811: 13.10. 2004., D1806: 26.09.2006., 16.10.2007. **Göd (D1669):** 22. 07.2003., 10.09.2003., 24.06.2004., 16.08.2004., D1489: 15. 09.2003., 01.07.2004., 25.09.2007., D1437: 10.06.2008. **Szigetköz floodplain:** Schisler-holtág: 24.06.2004., 16.08. 2004., 14.09.2004., 28.09.2005., 13.10.2005., 26.09.2006., 20.05.2008., Csákányi-Duna: 28.09.2005., Ásványi-Duna: 13.10.2004., Disznós-ág: 13.10.2005. **Gemenc floodplain:** GDU 07.05.2003., 27.05.2004., 23.05.2007., 25.09.2007., RDU 07.05.2003., 27.05.2004., 01.07.2004., 27.10.2004., 23. 05.2007., 25.09.2007., VDU 08.04.2002., 08.07.2003., 27.05. 2004., NYHD 07.05.2003., CSDU 07.05.2003., 25.09.2007. **Béda-Karapancsa floodplain:** BDU 25.10.2007., 10.06. 2008.

Cyclopoida

Acanthocyclops robustus (Sars, 1863)

Main arm: DKI 13.05.2003., 24.06.2004., 26.09.2006., 17.04.2007., 20.05.2008., 07.07.2008., 08.10.2008., DRE 13.05.2003., 07.07.2008., SZAP 01.09.1999., 04.07.2000., MED 17.04.2007., GOD 13.05.2003., 22.07.2003., 17.04. 2007., 09.07.2007., 20.05.2008., 07.07.2008., D1489 08.04. 2002., 07.05.2003., 08.07.2003., 01.07.2004., 26.08.2004., D1437 25.07.2007., 29.08.2007., 10.06.2008. **Szigetköz floodplain:** SCH 28.10.1999., 08.10.2002., 13.05.2003., 30. 10.2003., 24.06.2004., 14.09.2004., 28.09.2005., 17.04. 2007., 09.07.2007., 20.05.2008., CSA 14.09.2004., 26.09. 2006., 17.04.2007., 08.10.2008., ASV 10.04.2001., 13.05. 2003., DI 13.10.2005. **Gemenc floodplain:** GDU 08.04. 2002., 02.05.2002., 13.06.2002., 07.05.2003., 27.05.2004., 01.07.2004., 23.05.2007., RDU 08.04.2002., 02.05.2002., 13.06.2002., 07.05.2003., 08.07.2003., 14.04.2004., 26.08. 2004., 27.10.2004., 23.05.2007., 11.09.2007., 25.09.2007., VDU 02.05.2002., 03.07.2002., 07.05.2003., 08.07.2003., 15.09.2003., 27.10.2003., 14.04.2004., 01.07.2004., 26.08. 2004., 27.10.2004., 23.05.2007., NYHD 08.07.2003., 01.07. 2004., CSDU 07.05.2003., 25.09.2007. **Béda-Karapancsa floodplain:** BDU 10.06.2008.

Acanthocyclops vernalis (Fischer, 1853)

Main arm: DKI 23.08.2000., ARA 23.08.2000., GOD 04.07.2000., 23.08.2000. **Szigetköz floodplain:** SCH 04.07. 2000.

Cyclops insignis Claus, 1857

Gemenc floodplain: GDU 12.11.2002.

Cyclops scutifer Sars, 1863

Gemenc floodplain: NYHD 15.09.2003.

Cyclops strenuus Fischer, 1851

Main arm: SZAP 10.04.2001. **Gemenc floodplain:** GDU 12.11.2002., RDU 08.07.2003., VDU 03.07.2002., CSDU 07.05.2003., 27.10.2003., CIF 07.05.2003.

Cyclops vicinus Uljanin, 1875

Main arm: DKI 13.05.2003., GOD 20.05.2008., D1489 14.04.2004., 27.05.2004., 26.08.2004., D1437 29.08.2007., 25.10.2007., 18.03.2008., 10.06.2008. **Szigetköz floodplain:** SCH 14.09.2004., 16.10.2007. **Gemenc floodplain:** GDU 08.04.2002., 02.05.2002., 12.11.2002., 07.05.2003., 14.04. 2004., 27.05.2004., 27.10.2004., 23.05.2007., RDU 08.04. 2002., 13.06.2002., 14.04.2004., 27.05.2004., VDU 08. 04.2002., 02.05.2002., 14.04.2004., 25.09.2007., CSDU 25. 09.2007. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 29.08.2007., 25.10.2007., 18.03.2008.

Diacyclops bicuspidatus (Claus, 1857)

Main arm: GOD 04.09.2001., 18.09.2002. **Szigetköz floodplain:** CSA 11.10.2001., ASV 04.09.2001., 11.10.2001. **Gemenc floodplain:** GDU 08.04.2002., 02.05.2002., VDU 14.04.2004.

Ectocyclops phaleratus (Koch, 1838)

Gemenc floodplain: RDU 11.09.2007., CIF 07.05.2003.

Eucyclops macrurus (Sars, 1863)

Szigetköz floodplain: SCH 14.09.2004. **Gemenc floodplain:** GDU 27.10.2004., VDU 07.05.2003.

Eucyclops macruroides (Lilljeborg, 1901)

Szigetköz floodplain: SCH 14.09.2004. **Gemenc floodplain:** NYHD 07.05.2003., CSDU 27.10.2003.

Eucyclops serrulatus (Fischer, 1851)

Main arm: DKI 09.06.1999., 14.07.1999., 01.09.1999., 28.10.1999., 12.06.2002., 08.10.2002., 10.09.2003., 24.06.2004., 12.07.2005., 26.09.2006., DRE 07.07.2008., ARA 09.06.1999., 14.07.1999., 01.09.1999., 28.10.1999., 10.04.2001., 12.06.2002., 10.07.2002., SZAP 09.06.1999., 14.07.1999., 01.09.1999., 28.10.1999., MED 26.09.2006., GOD 09.06.1999., 14.07.1999., 01.09.1999., 10.09.2003., D1489 08.04.2002., 07.05.2003., 15.09.2003., D1437 25.10.2007. **Szigetköz floodplain:** SCH 09.06.1999., 14.07.1999., 01.09.1999., 28.10.1999., 18.09.2002., 10.09.2003., 24.06.2004., 14.09.2004., 13.10.2005., CSA 09.06.1999., 01.09.1999., 28.10.1999., 04.07.2001., 04.09.2001., 13.05.2003., 16.08.2004., ASV 09.06.1999., 14.07.1999., 28.10.1999., 13.05.2003., 10.09.2003., 24.06.2004., 13.10.2004., 12.07.2005., 26.09.2006., CIK 16.10.2007., DI 13.10.2005. **Gemenc floodplain:** GDU 08.04.2002., 13.06.2002., 12.11.2002., 07.05.2003., 15.09.2003., 27.05.2004., 01.07.2004., 23.05.2007., RDU 02.05.2002., 13.06.2002., 03.07.2002., 07.05.2003., 15.09.2003., 27.10.2003., 14.04.2004., 27.05.2004. 01.07.2004., 27.10.2004., 23.05.2007., VDU 08.04.2002., 02.05.2002., 13.06.2002., 07.05.2003., 08.07.2003., 15.09.2003., 27.10.2003., 14.04.2004., 27.05.2004., 01.07.2004., 26.08.2004., 11.09.2007., 25.09.2007., NYHD 07.05.2003., 08.07.2003., 15.09.2003., 14.04.2004., CSDU 07.05.2003., 27.10.2003., 25.09.2007., CIF 07.05.2003. **Béda-Karapancsa floodplain:** BDU 25.10.2007., 18.03.2008., 10.06.2008.

Macrocyclops albidus (Jurine, 1820)

Main arm: DKI 24.06.2004., 07.07.2008. **Szigetköz floodplain:** SCH 24.06.2004., 28.09.2005., 04.07.2006., CSA 11.10.2001., 16.08.2004. **Gemenc floodplain:** NYHD 07.05.2003., 08.07.2003., 15.09.2003., CSDU 07.05.2003., 27.10.2003., CIF 07.05.2003.

Macrocyclops fuscus (Jurine, 1820)

Szigetköz floodplain: SCH 14.09.2004. **Gemenc floodplain:** CSDU 07.05.2003.

Megacyclops viridis (Jurine, 1820)

Gemenc floodplain: GDU 07.05.2003., 27.05.2004., VDU 27.05.2004., NYHD 07.05.2003., 08.07.2003., CSDU 07.05.2003., 27.10.2003., 25.09.2007., CIF 07.05.2003.

Mesocyclops leuckarti (Claus, 1857)

Main arm: DKI 04.09.2001., 11.10.2001., 12.06.2002., 18.09.2002., 08.10.2002., 13.05.2003., 10.09.2003., DRE 10.09.2003., 17.04.2007., SZAP 11.10.2001., 08.10.2002., GOD 23.08.2000., 10.09.2003., D1489 03.07.2002., 07.05.2003., 14.04.2004., D1437 25.07.2007. **Szigetköz floodplain:** SCH 04.07.2000., 23.08.2000., 10.04.2001., 04.09.2001., 12.06.2002., 10.07.2002., 18.09.2002., 08.10.2002., 13.05.2003., 22.07.2003., 10.09.2003., 30.10.2003., 16.08.2004., 14.09.2004., 28.09.2005., 13.10.2005., 26.09.2006., 17.04.2007., 16.10.2007., 07.07.2008., CSA 18.10.2000., 08.10.2002. **Gemenc floodplain:** GDU 08.04.2002., 02.05.2002., 13.06.2002., 03.07.2002., 12.11.2002., 07.05.2003., 14.04.2004., 01.07.2004., 23.05.2007., 25.09.2007., RDU 02.05.2002., 13.06.2002., 07.05.2003., 15.09.2003., 14.04.2004., VDU 13.06.2002., 03.07.2002., 07.05.2003., 08.07.2003., 25.09.2007., NYHD 07.05.2003., 08.07.2003., 15.09.2003., 01.07.2004., CSDU 07.05.2003., CIF 07.05.2003.

Microcyclops varicans (Sars, 1863)

Gemenc floodplain: CSDU 07.05.2003.

Paracyclops affinis (Sars, 1863)

Szigetköz floodplain: CSA 04.07.2001. **Gemenc floodplain:** CSDU 07.05.2003.

Paracyclops fimbriatus (Fischer, 1853)

Main arm: DKI 08.10.2008.

Thermocyclops dybowskii (Lande, 1890)

Gemenc floodplain: GDU 27.05.2004. **Béda-Karapancsa floodplain:** BDU 29.08.2007.

Thermocyclops crassus (Fischer, 1853)

Main arm: DKI 13.10.2004., 16.10.2007., DRE 07.07.2008., D1489 27.05.2004., 27.10.2004., 11.09.2007., 25.09.2007. **Szigetköz floodplain:** SCH 14.09.2004., 13.10.2004., 12.07.2005., 04.07.2006., 26.09.2006., 17.04.2007., 07.07.2008., CSA 26.09.2006., DI 14.09.2004. **Gemenc floodplain:** GDU 02.05.2002., 13.06.2002., 03.07.2002., 07.05.2003., 15.09.2003., 27.05.2004., 01.07.2004., 27.10.2004., 23.05.2007., 11.09.2007., 25.09.2007., RDU 25.09.2007., NYHD 07.05.2003., 08.07.2003., 15.09.2003., 01.07.2004., CSDU 25.09.2007., CIF 07.05.2003.

Thermocyclops oithonoides (Sars, 1863)

Main arm: D1489 03.07.2002., 08.07.2003., 15.09.2003., 01.07.2004., D1437 29.08.2007., 25.10.2007., 10.06.2008. **Szigetköz floodplain:** SCH 14.09.2004., CSA 13.05.2003., DI 14.09.2004. **Gemenc floodplain:** RDU 08.07.2003., 15.09.2003., 27.10.2003., 27.05.2004., 01.07.2004., 26.08.2004., 27.10.2004., 25.09.2007., VDU 08.04.2002., 08.07.2003., 15.09.2003., 01.07.2004., 26.08.2004., 27.10.2004., 11.09.2007., 25.09.2007., NYHD 07.05.2003., 08.07.2003., 15.09.2003., 01.07.2004. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 29.08.2007., 25.10.2007., 10.06.2008.

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Remarks on the genus *Afrotrachytes* Kontschán, 2006 (Acari: Uropodina), with description of two new species

J. KONTSCHÁN[1]

Abstract. In this paper two new species of the genus *Afrotrachytes* Kontschán, 2006 are presented: *Afrotrachytes bercziki* and *A. mirabilis* spp. nov. They represent the first records of the genus in South America (Ecuador) and West Africa (Cameroon), respectively.

The uropodine genus *Afrotrachytes* was established by Kontschán (2006 a) on the basis of a newly described species, *Afrotrachytes seticaudatus* Kontschán, 2006 collected in Angola. In the very same year, Kontschán (2006 b) described a further new species of this genus, *Afrotrachytes longicaudatus* Kontschán, 2006 from Tanzania.

Present paper contains the first South American and West African records of this genus with description of two new species. On the basis of these new fascinating occurrences, the endemic status of *Afrotrachytes* in Africa is reconsidered.

MATERIAL AND METHODS

Specimens were cleared in lactic acid and later stored in alcohol. Drawings were made with a drawing tube. Specimens examined are deposited in the Soil Zoology Collections of the Hungarian Natural History Museum, Budapest (Hungary) and the Arachnida Collection of the Natural History Museum, London (United Kingdom). Abbreviations used: h1-h4, hypostomal setae, St1-St5, sternal setae. All measurements are given in micrometres (μm).

DESCRIPTIONS

Afrotrachytes Kontschán, 2006

Afrotrachytes Kontschán, 2006a: p. 2.; Kontschán 2006b: p. 53.

Diagnosis. Color yellowish-brown. Idiosoma oval with long vertex. Legs as long as idiosoma. First legs without ambulacral claws. All legs bear wide dorsal and ventral processes and wide phylliform setae. Dorsal and marginal shields fused anteriorly, postdorsal shield present. Several (three pairs or more) long and phylliform caudal setae can be seen on ventral and dorsal idiosoma. One pair of horn-like anterior humps is found on dorsal idiosoma in the level of coxae II. Genital shield of female oval, without anterior process.

Type species. Afrotrachytes seticaudatus Kontschán, 2006 by original designation.

Known species. A. seticaudatus Kontschán, 2006 from Angola and *A. longicaudatus* Kontschán, 2006 from Tanzania.

Afrotrachytes bercziki sp. nov.

(Figs. 1–4)

Material examined. Holotype: female. Ecu. B. 65, Ecuador, Prov. Pichincha, Chiriboga, 1850 m a.s.l., 18. IV. 1989; secondary rain forest, from leaf litter and soil; collected by A. Zicsi and I. Loksa (Zicsi and Csuzdi, 2008). Paratype: one female. Locality and date same as that of the holotype. Holotype and paratype are deposited in the Soil Zoology Collections of the Hungarian Natural History Museum, Budapest.

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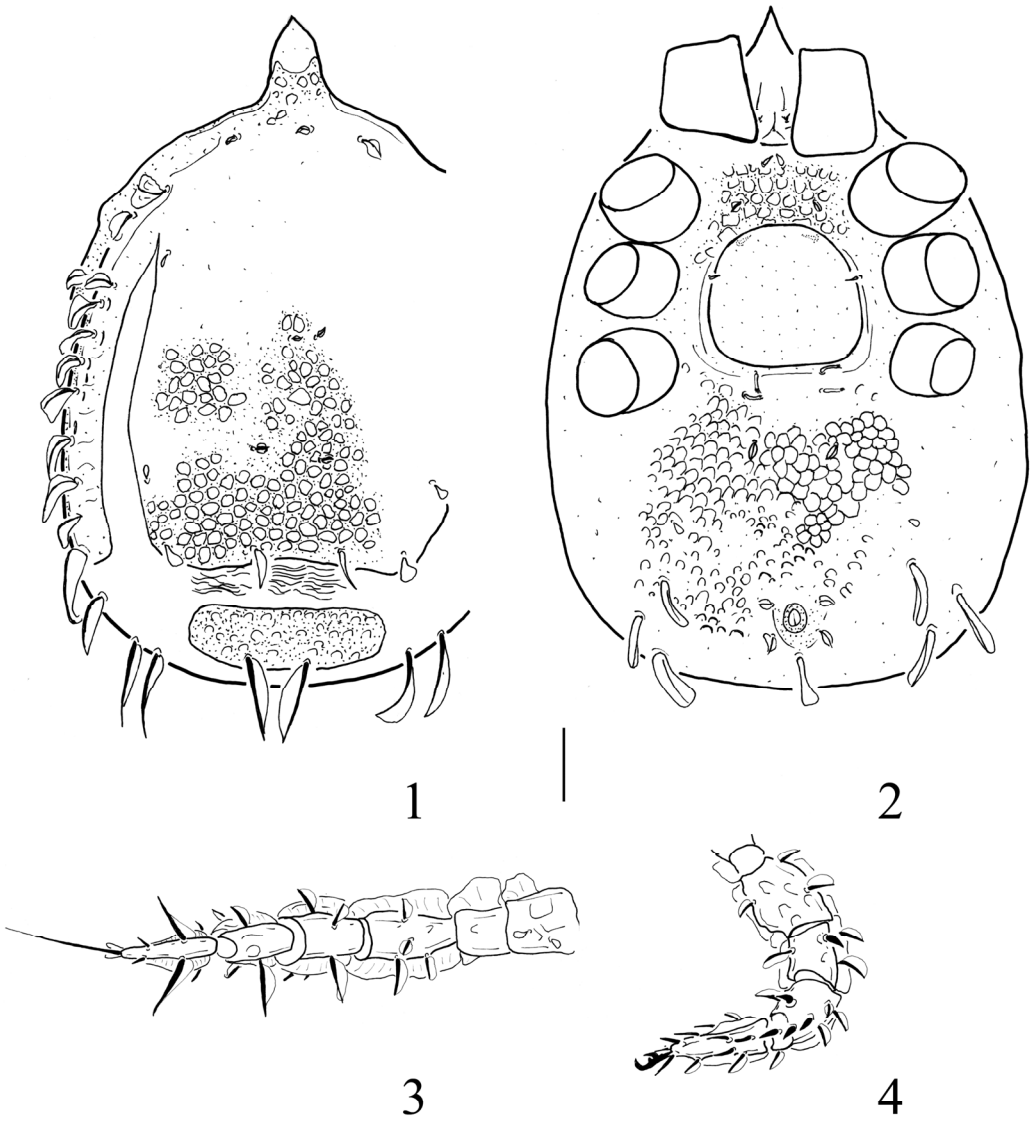


Figures 1–4. *Afrotrachytes bercziki* n. sp. (female). 1 = dorsal view, 2 = ventral view, 3 = leg I., 4 = leg IV. (Scale bar: 100 μm)

Diagnosis. Dorsal, sternal and postdorsal shield covered by alveolar ornamentation, sculptural pattern of ventral shield squamosus. Dorsal setae short and phylliform, marginal setae long, wide and phylliform. Adanal setae phylliform, postanal seta spatuliform. First and second sternal setae phylliform, St3 and St4 needle-like, St5 and V1 apically serrated.

Female. Length of idiosoma 950–960 μm, diameter 630–650 μm (n = 2). Shape oval, posterior margin rounded, vertex present.

Dorsal idiosoma (Fig. 1). Dorsal and marginal shields anteriorly fused. Dorsal setae short and phylliform, except two pairs near the posterior margin of dorsal shield, which two times longer

than the others. Marginal setae wide, long and phylliform. Postdorsal shield bears one pair of long phylliform seta. Three pairs of long phylliform setae placed on membranous cuticle near the caudal region. Dorsal and postdorsal shields covered by alveolar sculptural pattern.

Ventral idiosoma (Fig. 2). Basis of tritosternum wide, subtriangular, tritosternal laciniae not clearly visible. Sternal shield with alveolar ornamentation. All sternal setae short. St1 and St2 phylliform and placed between coxae II. St3 and St4 needle-like found near to the margins of genital shield in level of coxae III. St5 and V1 anteriorly serrated and placed near to the posterior margin of genital shield. Two pairs of short and phylliform setae and three pairs of long and leaf-like setae can be seen on the ventral shield. Two pairs of adanal setae short and phylliform, postanal seta three times longer than adanal setae and spatuliform. Ornamentation of ventral shield tile-like.

Genital shield oval, without ornamentation and process.

Legs (Figs 3–4). Leg I without ambulacral claws. Each leg bears phylliform setae and wide dorsal and ventral processes.

Gnathosoma. Only partly visible. Corniculi horn-like, h1 long and setiform, h2 short and anteriorly bifurcated. Epistome, palps and chelicerae not clearly visible.

Male, nymphs and larvae were not observed.

Etymology. The new species is dedicated to Prof. Dr. Árpád Berczik on his eightieth birthday.

Afrotrachytes mirabilis sp. nov.

(Figs. 5–11)

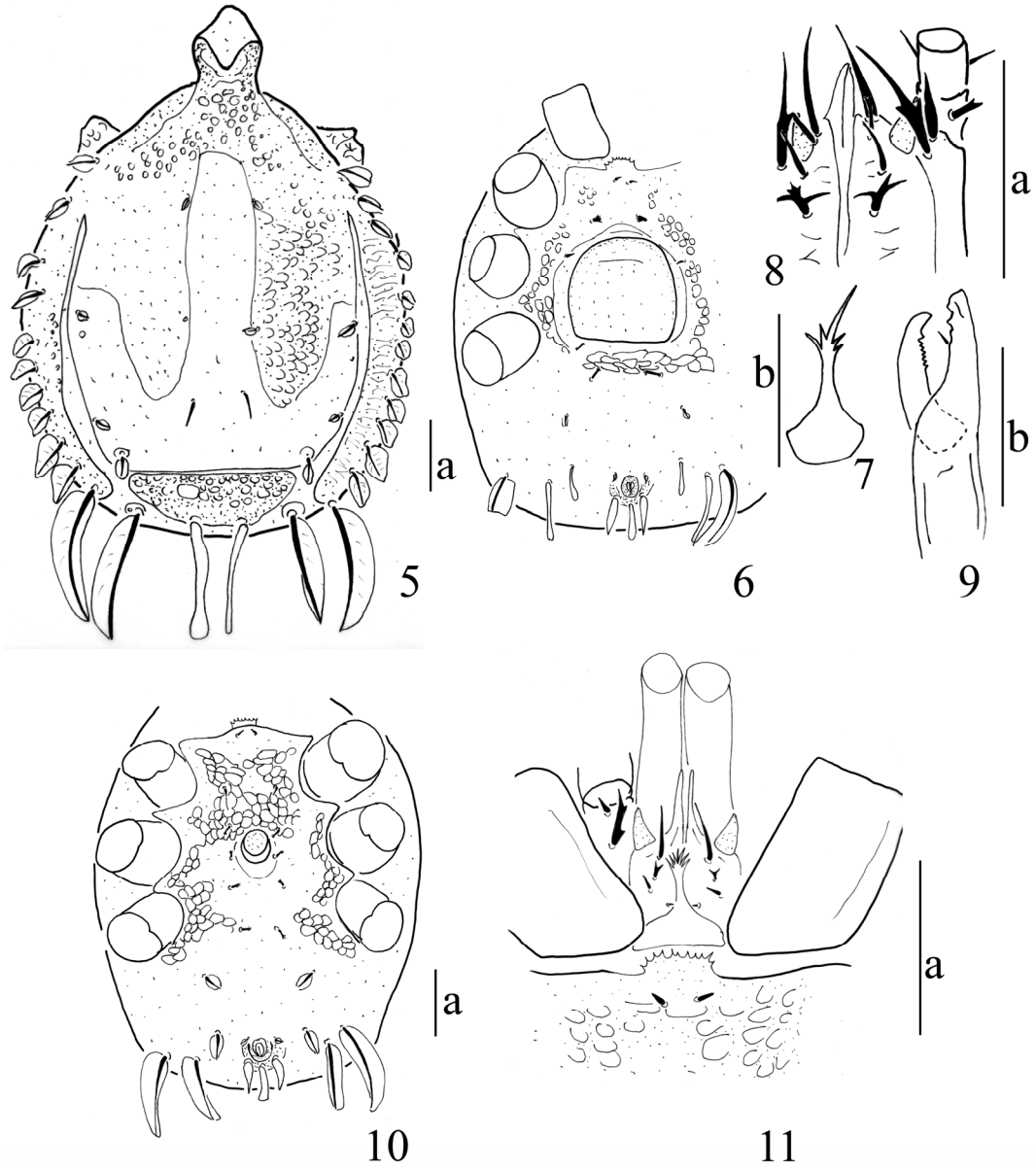
Material examined. Holotype: female. Cameroon, SW Prov., Songo, forest at edge of rubber plantation, from leaf litter, 16. VIII. 1988. Leg. M. Judson. Paratype: three females and two males. Locality and date same as that of the holotype. Holotype and paratypes are deposited in the Arachnida Collection of the Natural History Museum, London.

Diagnosis. Anterior part of dorsal-, sternal and postdorsal shield covered by alveolar ornamenttation. Sculptural pattern of the lateral region of dorsal shield squamosus. Ventral shield without ornamentation. Dorsal setae short and phylliform, only one pair of setae needle-like, found on the central part. Marginal setae long, wide and phylliform. Adanal setae phylliform, the first pair four times shorter than the second pair, postanal seta spatuliform. First sternal setae needle-like, second sternal setae subtriangular and apically serrated, St3 needle-like, St5 and V1 apically serrated. Phylliform setae on caudal part of dorsum four times longer than the marginal setae. Setae on postdorsal shield long and spatuliform.

Female. Length of idiosoma 710–730 μm, width 510–540 μm (n = 4). Shape oval, posterior margin rounded, vertex present.

Dorsal idiosoma (Fig. 5). Dorsal and marginal shields anteriorly fused. Dorsal setae short and phylliform, only one pair of needle-like setae is found on the central region of dorsal shield. Marginal setae wide, long and phylliform. Postdorsal shield bears one pair of long spatuliform seta. Two pairs of very long (four times longer than the marginal setae) phylliform setae can be seen on caudal region, one of them placed on membranous cuticle and the other pair on the caudal part of the marginal shield. Anterior region of dorsal shield bears alveolar ornamentation. Lateral region with tile-like sculptural pattern, central and caudal regions smooth. Postdorsal shield covered by alveolar ornamentation.

Ventral idiosoma (Fig. 6). Basis of tritosternum wide, subtriangular, tritosternal laciniae subdivided in five branches (Fig. 7). Sternal shield with alveolar ornamentation. All of sternal setae short. St1 needle-like, St2 subtriangular, apically serrated and placed between coxae II. St3 needle-like found near the margins of genital shield, on the level of coxae III. St4 not clearly visible.



Figures 5–11. *Afrotracyhtes mirabilis* n. sp. (female). 5 = dorsal view, 6 = ventral view, 7 = tritosternum, 8 = ventral view of gnathosma, 9 = chelicerae, 10 = ventral view of male, 11 = ventral view of male gnathosoma.
(Scale bar a: 100 μm, B: 20 μm)

St5 and V1 anteriorly serrated and placed near of the posterior margin of genital shield. One pair of short and phylliform setae, two pairs of long and spatuliform setae and one pair of long phylliform setae can be seen on the ventral shield. First pair of adanal setae short and phylliform, second pair also phylliform and four times longer than the first pair. Postanal seta spatuliform, as long as the second pair of adanal setae. Ventral shield mostly without ornamentation, but near the posterior margin of genital shield some tile-like sculptural pattern can be seen.

Genital shield oval, without ornamentation and process.

Legs. Leg I without ambulacral claws. All legs bear phylliform setae and wide dorsal and ventral processes.

Gnathosoma (Fig. 8). Corniculi horn-like, internal malae long and smooth. Hypostomal setae as follows: h1 long and setiform, h2 three times shorter than h1 and antreriorly bifurcated, h3 two times longer than h2, smooth and needle-like, h4 as long as h3 and antler-shaped. Setae on palp trochanter are depicted on Fig. 8. Chelicerae (Fig. 9) with several short teeth on movable digit, two big teeth and one spine on fixed digit. Nodus absent. Epistome not clearly visible.

Male. Length of idiosoma 640–710 μm, width 490–530 μm (n=2). Shape oval, posterior margin rounded, vertex present.

Dorsal idiosoma. Ornamentation and chaetotaxy same as in female.

Ventral idiosoma (Fig. 10). Basis of tritosternum wide, subtriangular, tritosternal laciniae subdivided in five branches (Fig. 11). Sternal shield with alveolar and tile-like ornamentation. All sternal setae short. St1 and St2 needle-like, St1 placed near the anterior margin of sternal shield, St2 between coxae II. St3, St4 and St5 anteriorly serrated, St3 can be found near the anterior margin of genital shield, St4 near the posterior margin of genital shield, St5 placed between coxae IV, on the level of anterior margin. V1 serrated anteriorly and placed near the level of posterior margin of coxae IV. Two pairs of short and two pairs of long phylliform setae can be found on the ventral shield. Adanal and postanal setae same as in female.

Genital shield rounded, placed between coxae III.

Gnathosoma (Fig. 11). Similar to that of the female.

Nymphs and larvae are unknown.

Etymology. The specific epithet refers to the attractive appearance of this species.

Key to the *Afrotrachytes* species

1. Ornamentation between the ventral setae present....2
– Ornamentation between the ventral setae absent.....3

2. Genital shield of female ornamented, V1 setae subtriangular .....***A. longicaudatus***
– Genital shield of female smooth, V1 setae phylliform .....***A. bercziki***

3. Two postanal setae present, ornamentation on ventral shield near the posterior margin of genital shield absent, St2 needle-like.....***A. seticaudatus***
– One postanal seta present, ornamentation on ventral shield near the posterior margin of genital shield present, St2 subtriangular and serrated apically ....***A. mirabilis***

DISSCUSSION

Recently only four *Afrotrachytes* species are known world-wide. Three of them occur in tropical Africa: *A. seticaudatus* in Angola, *A. longicaudatus* in Tanzania and *A. mirabilis* in Cameroon, while the fourth species (*A. bercziki*) is reported from Ecuador, South America (Fig. 12).

When Kontschán (2006 a) described this genus he thought that it is endemic in Africa, hence named it *Afrotrachytes*. However, discovering a new species in Ecuador an interesting amphiatlantic distribution pattern of the group was revealed. This kind of distribution is not an unknown phenomenon among the soil meso- and macrofauna. Csuzdi (1993, 1994) mentioned this phenomenon for dichogastrid earthworms, and later Karg and Schorlemmer (2009) found the same kind of characteristic occurrences in the free living Gamasina mites.

Karg and Schorlemmer (2009) recording two African mite genera (*Africoseius* Krantz, 1962 and *Rykellus* Lee, 1970) in South America, supposed that these two groups must have been developed during a geological period when the African and South-American continents were still connected but separated from the other continents.

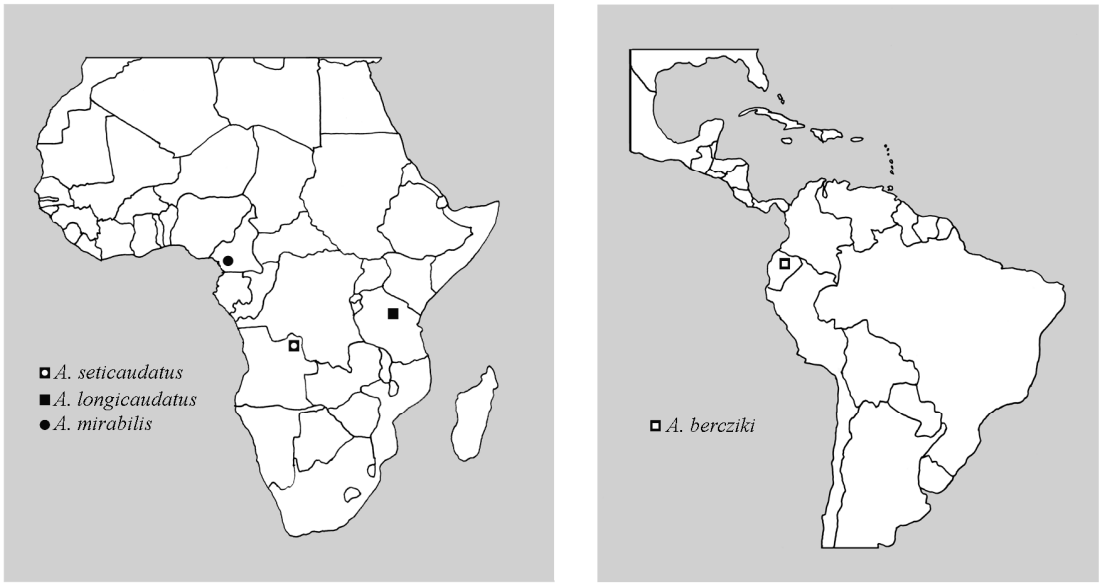


Figure 12. Distribution of the *Afrotrachytes* species

This connection lasted until the upper Cretaceous, ca. 80 million years ago. I suppose the genus *Afrotrachytes*, which shows a similar distribution to *Africoseius* and *Rykellus* also, originated in the upper Cretaceous.

Acknowledgements – My thanks are due to Dr Sándor Mahunka, Dr Csaba Csuzdi and Mr Zsolt Ujvári for their valuable comments on the manuscript. I am also grateful to Dr Anne Baker and Mrs Janet Beccaloni for their kind hospitality during my study in London.

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Oribatid mites from the Vohimana Reserve, Madagascar (Acari: Oribatida), II.

S. MAHUNKA[1]

Abstract. Further studies on the oribatid species collected from the Vohimana Reserve (Madagascar) are presented. Altogether 13 species are listed, of them two represent new genera (*Rugocepheus* gen. nov. and *Madabelba* gen. nov.), furthermore seven species are new to science. The other six species were earlier mentioned from different regions of the island, they are however little known. With 23 figures.

INTRODUCTION

I am working continuously on the exploration of the oribatid fauna of Madagascar since the end of the last century (e. g. Mahunka, 2002). The final goal is to write a monograph of this very rich and peculiar fauna. Therefore in the last years several papers with descriptions of new taxa were published (2009 a, 2009 b) or are in preparation.

To achieve this main goal, it is important to examine more freshly collected or not completely studied soil samples. For this reason I continue the examination of an interesting material, which was collected recently by Dr. Cs. Csuzdi, the well-known Hungarian specialist of earthworms, when visited Madagascar in 2008. He carried out soil zoological collecting activities on the northern part of the great island, namely in the Vohimana Nature Reserve, in an area from whence no data on oribatids have hitherto been published. Hereby I describe the second part of the oribatid mites found in his material.

In this paper I discuss thirteen species belonging to different oribatid families. Of them, seven are new to science: *Hymenobelba flagellatissima*, *Rugocepheus formosus, Pseudotocepheus atolanaro, Multioppia malalatinae, Oxyoppia* (*O.*) *tuberosa, Madabelba bercziki* and *Protoripoda nasuta* spp. nov. Six interesting or rare species are known exclusively from the great island. Among the seven new species, wo represent new genera: *Rugocepheus formosus* gen. et sp. nov. from the family Carabodidae and *Madabelba bercziki* gen. et sp. nov. from the family Suctobelbidae.

In this paper, I follow the system of Norton and Behan Pelletier (2009), based on that of Grandjean (1954, 1965), and besides I also use the works of Subías (2004, 2009). In the descriptions the morphological terminology of Grandjean (1965 and in several publications) was used with some complementary modifications concerning the studied groups or specific organs (e.g. Mahunka & Zombori, 1985; Norton *et al*., 1997; Mahunka & Mahunka-Papp, 2001; Niedbała, 2001, 2008; Woas, 2002; Weigmann, 2006) and the already mentioned publication of Norton & Behan Pellettier (2009).

Depositories. The material examined is deposited at the Hungarian Natural History Museum, Budapest (HNHM), and some paratypes and vaucher specimens in the Muséum d'histoire naturelle de Genève (MHNG).

LOCALITY

Afr-996: Malagasy Republic (Madagascar), Vohimana reserve, primary forest. 17. 04. 2008. Leg. Cs. Csuzdi.

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LIST OF THE SPECIES IDENTIFIED

HERMANNIIDAE Sellnick, 1928

Hermannia (*Phyllhermannia*) *exornata* (Balogh, 1962)
Locality: Afr-996.

AMERIDAE Grandjean, 1965

Hymenobelba flagellatissima sp. n.

CARABODIDAE C. L. Koch, 1837

Rugocepheus formosus gen. et sp. n.

TETRACONDYLIDAE Aoki, 1961

Pseudotocepheus atolanaro sp. n.

OPPIIDAE Sellnick, 1937

Fossoppia calcarata Mahunka, 1997
Locality: Afr-996

Leptoppia benyovszkyi Mahunka, 1996
Locality: Afr-996

Leptoppia procera Mahunka, 1997
Locality: Afr-996

Multioppia malalatinae sp. n.

Oxyoppia (*Oxyoppia*) *tuberosa* sp. n.

SUCTOBELBIDAE Jacot, 1938

Persuctobelba monster Mahunka, 2001
Locality: Afr-996.

Madabelba bercziki gen. et sp. n.

ORIPODIDAE Jacot, 1925

Protoripoda nasuta sp. n.

GALUMNIDAE Jacot, 1925

Galumna armatifera Mahunka, 1996
Locality: Afr-996.

DESCRIPTIONS OF THE NEW TAXA

Hymenobelba flagellatissima sp. nov.

(Figs. 1–3)

Diagnosis. All prodorsal and notogastral setae long, filiform, sometimes flagellate. Prodorsal setae arising on tubercles. Sensillus very long, filiform, finely ciliate. Anterolateral margin of prodorsum serrate. Pedotecta I large, rounded, pedotecta II–III reduced. No apodemes on anterior part of epimeral region, sejugal apodemes well developed. All epimeral setae long and thin, aggenital and adanal neotrichy. All setae in this region sword shaped, sometimes with flagellate distal end. All legs monodactylous.

Material examined. Holotype: Malagasy Republic, Vohimana Reserve, primary forest. 17. 04. 2008. Leg. Cs. Csuzdi (Afr-996). 5 paratypes from the same sample. Holotype (1791-HO-09) and 3 paratypes (1791-PO-09) deposited in HNHM, 2 paratypes in MHNG.

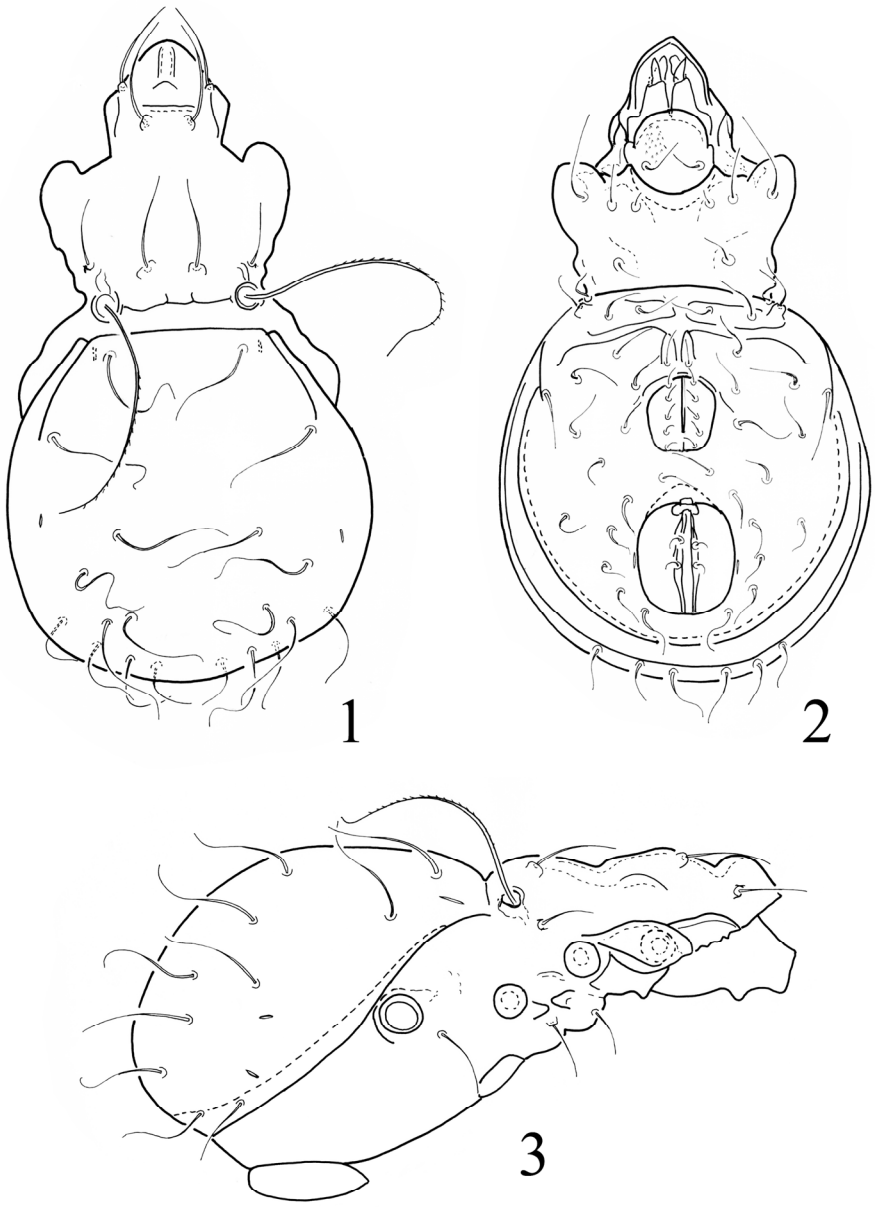
Measurements. Length of body: 439–506 μm, width of body: 252–297 μm.

Prodorsum. Rostral part wide, rostrum conical with a pair of weak longitudinal laths and a transversal one located in front of lamellar setae. All four pairs of prodorsal setae inserted in tubercles, far from one another. All setae long, their length: *le – in – ro – ex*. A weak transversal line in interbothridial region present. Bothridium cup-shaped, sensillus long, setiform, curving slightly distally, finely ciliate.

Notogaster. Dorsosejugal furrow straight, with a pair of small humeral processes. Notogastral surface without lateral cavities. Ten pairs of notogastral setae, all filiform, mostly flagellate (Fig. 1). Anterior setae nearly equal in length, only setae *p* much shorter.

Lateral part of podosoma. Prodorsum characteristically excavate behind the rostrum and in medial part. Lateral margin serrate. Pedotecta I very large, rounded distally. Tutorium well developed, curving laterally. Pedotecta II dentiform (Fig. 3).

Ventral parts (Fig. 2). Surface punctate, without well developed structure, only sejugal and apodemes IV visible. Epimeral setae located on epimeres I–III thin, setiform, setae on epimeres



Figures 1–3. *Hymenobelba flagellatissima* sp. n. 1 = body in dorsal view, 2 = body in ventral view. 3 = body in lateral view

IV slightly dilated basally. Length of setae highly varying, setae *1c* longest of all, setae *1a* and *2a* shortest of all. Setae *3c* arising on tubercles. Epimeral setal formula: 3-1-3-3-. Genital setae arising in longitudinal rows. Anal setae arising medially on two longitudinal crests. Aggenital and adanal neotrichy present.

Legs. All legs conspicuously thin, monodactylous. Claws on legs I thinner and smaller than on legs II–IV. Setae *u* on legs II–IV thick, spiniform.

Remarks. The new species is well characterised by the absence of the prodorsal sculpture, the

form and length of the prodorsal and notogastral setae, the distance of the lamellar and interlamellar ones and the absence of the notogastral cavity. On the basis of most these features *H. flagellatissima* sp. nov. stands nearest to *H. flexisetosa.* Luxton, 1988, however the prodorsal setae of the new species arising on tubercles stand far from each other.

Etymology. Named after the form of notogastral setae.

Rugocepheus gen. nov.

Diagnosis. Family Carabodidae. Body covered by secretion layer. Lamellae narrow with median transversal extension, lamellar setae arising on separate tubercles of the lamellar surface, translamella absent. Humeral apophyses small, no setae in humeral position. Ten pairs of large, notogastral elevations bearing long, thin setiform setae. Fourteen pairs of thin, setiform notogastral setae, among them 4 pairs in posteromarginal position. Gnathosoma with median transversal protuberances. Epimeral region well sclerotised, sternal apodemes absent, sternal region very wide, with an annular ring-shaped formation anteriorly. All epimeres located far from each other. Four pairs of genital, 1 pair of aggenital, 2 pairs of anal and 3 pairs of adanal setae. Lyrifissures *iad* located far from the anal aperture. All legs tridactylous.

Type species: *Rugocepheus formosus* sp. n.

Remarks. Form of the lamellar protuberances, the ten pairs of notogastral elevation combined with the thin and long notogastral setae, the form of the epimeral structure and the well sclerotised ventral region as a feature combination has been unknown in the family Carabodidae. First of all, the position of the lamellar setae and the form of the notogastral protuberances and setae are unique in this family. On this basis the new genus is well distinguishable from all other genera of the family.

Rugocepheus formosus sp. nov.

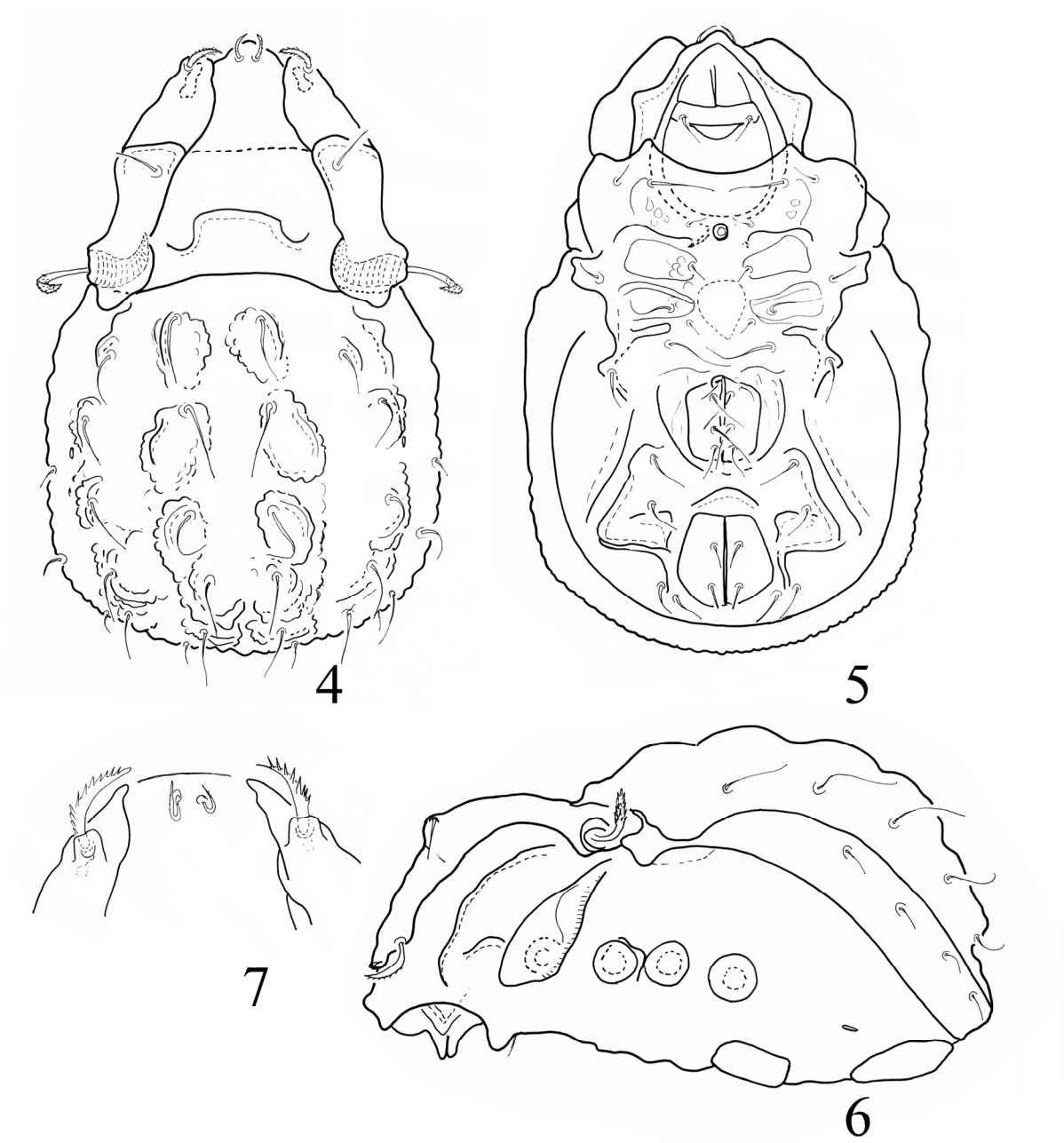
(Figs. 4–7)

Diagnosis. Rostral apex protruding anteriorly, rostral setae arising near to each other. Lamellar cusps narrowing anteriorly, spiniform, lamellar setae arising on tubercles, located behind the cusps; lamellae with transversal line medially. Interlamellar region with a curved, strong median crest. Interlamellar setae setiform. Sensillus short, directed backwards, with recurved distal end. Notogaster with 10 pairs of large elevations bearing thin, setiform notogastral setae. Further four pairs of notogastral setae in posteromarginal position. Infracapitulum peculiarly protruding. Epimeral region with distinct apodemes and borders, epimeral setae varying in length. Ventral region with longitudinal and transversal ribs, Genitoanal setal formula 4-1-2-3, genital setae conspicuously long. Lyrifissures *iad* well observable, located far from the anal opening.

Material examined. Holotype: Malagasy Republic, Vohimana Reserve, primary forest. 17. 04. 2008. Leg. Cs. Csuzdi (Afr-996). 1 paratype from the same sample. Holotype (1792-HO-09) and 1 paratype (1792-PO-09) in HNHM, 1 paratype in MHNG.

Measurements. Length of body: 596–625 μm, width of body: 362–439 μm.

Prodorsum. Rostrum with small, rounded apex, rostral setae arising very near to each other, between the conspicuously long and narrow lamellar apices (Fig. 4). Lamellae long, with distinct apices, lamellar setae located behind them on tubercles of the lamellar surface (Fig. 7). Anterior and posterior part of the prodorsum marked by an angular line, in the posterior part a pair of the characteristic transversal costulae also present. Interlamellar setae setiform, arising on the lamellar surface, near to the transversal elevations. Bothridium long, curved anteriorly, horn-shaped; sensillus short, curved, lanceolate, with recurved distal end.



Figures 4–7. *Rugocepehus formosus* gen. et sp. n. – 4 = body in dorsal view, 5 = body in ventral view, 6 = body in lateral view 7 = rostral region

Notogaster. Dorsosejugal furrow slightly convex. Humeral apophyses small, distinct, directed forwards. Ten pairs of large notogastral elevation, with undulate margin, bearing long, thin setiform setae, directed backwards. They are nearly as long as the elevations. Altogether fourteen pairs of thin, setiform notogastral setae, among them 4 pairs in posteromarginal position. These latter ones much shorter than the median setae. All setae smooth.

Lateral part of podosoma. Tutorium weak, simple, without apex (Fig. 6). Pedotectum I large, smooth. Lamellar setae phylliform, with unilaterally serrate margin. Pedotectum II large.

Ventral parts (Fig. 5). Apodemes and borders typical for the genus, well sclerotised and observable. Sternal region wide, with an annular formation anteriorly and a heart-shaped field medially present. Epimeral setal formula 3-1-3-3, among the inner ones and setae *1c*, *3c*, and *4c* short, simple, setae *1b*, *3b* and *4b* very long, flagellate. Behind the epimeral borders IV a pair of well-developed longitudinal and angulate transversal laths directed inwards present. In front of the anal aperture a semicircular rib also observable. All setae in the ventral region conspicuously thin, long, setiform. All anal and adanal setae also fine and long, setae ad_1 and ad_2 arising very near to each other. Lyrifissures *iad* well observable, located far from the anal aperture.

Legs. All segment without foveolae. Femora of legs II-IV with blade like formation basally.

Remarks. See the remarks after the genus diagnosis.

Etymology. Named after the fascinating notogastral sculpture.

Pseudotocepheus atolanaro **sp. n.**

(Figs. 8–11)

Diagnosis. Rostral part of prodorsum wide, rostral apex rounded. Lamellae converging anteriorly, narrow, straight. Whole interlamellar surface foveolate. Sensillus fusiform. Median prodorsal condyles large, semicircular. Dorsosejugal margin of notogaster slightly concave, with indistinct lateral condyles. Surface of notogaster distinctly punctate. All notogastral setae finely aciculate (roughened), their distal end spiniform. Apodemes, excepting *ap. 4* well developed, *ap. 2* and *ap. sej.* straight. *Ap. 4* much thinner and shorter than the others. Genitoanal setal formula 3-1-3-3. Genital and aggenital setae very short, anal and adanal ones much longer than latters. Lyrifissures *iad* located far from the anal aperture.

Material examined. Holotype: Malagasy Republic, Vohimana Reserve, primary forest. 17. 04. 2008. Leg. Cs. Csuzdi (Afr-996). Holotype (1793-HO-09) deposited in HNHM.

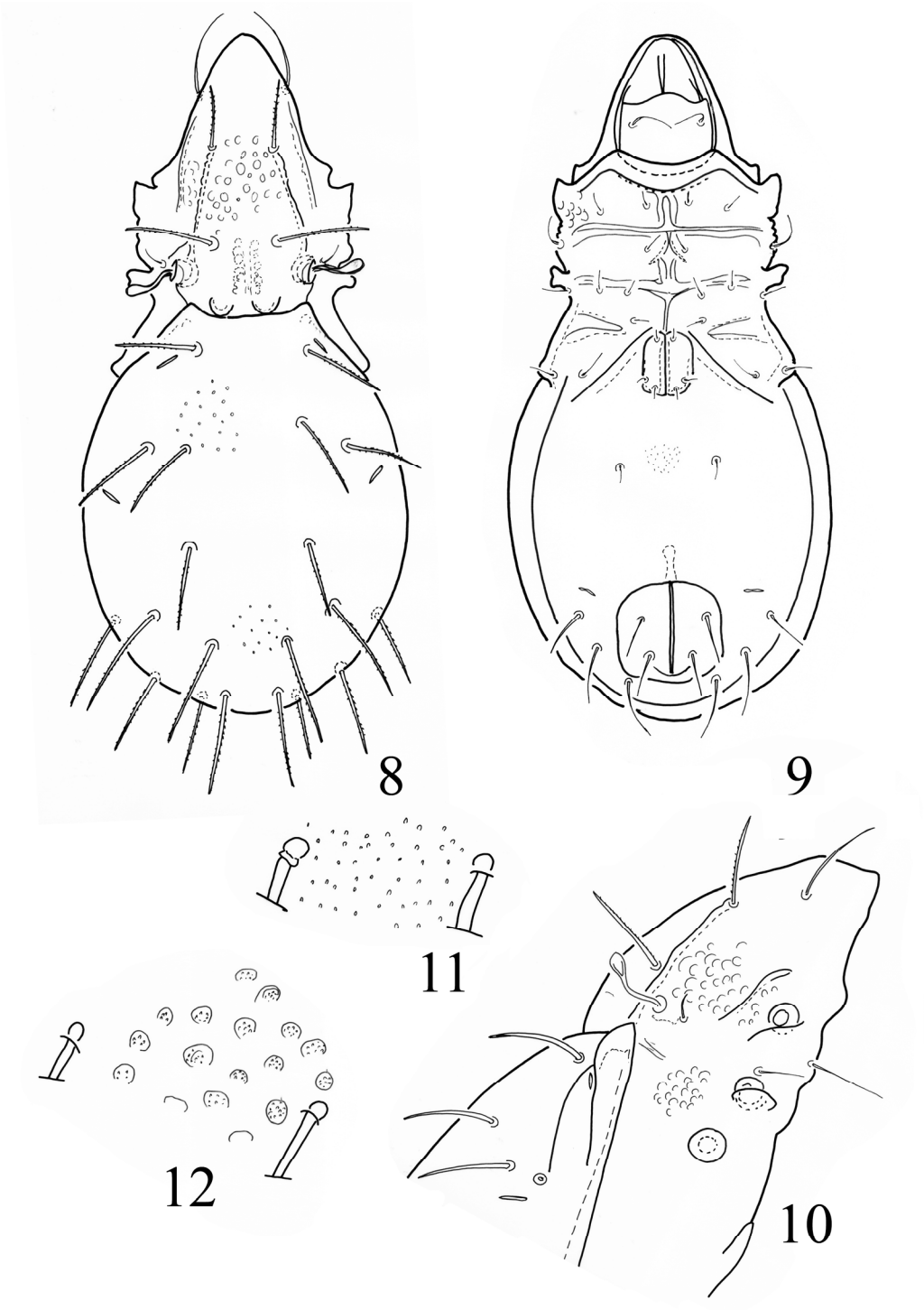
Measurements. Length of body: 730 μm, width of body: 290 μm.

Prodorsum. Rostrum rounded, rostral setae setiform, smooth, with fine distal end, located far from the rostral apex. Lamellae narrow, diverging from each other, their margin indistinct (Fig. 8). Distal end without apex, bearing needle-shaped lamellar setae. Interlamellar surface covered by foveolae, posteromedian part with 2 rows of weaker, irregular spots. Interlamellar setae also needle shaped, straight, exobothridial setae short, curved, setiform. Sensillus small, its peduncle bent, directed outwards. Its head fusiform, rounded. One pair of comparatively large median prodorsal condyles present, lateral ones indistinct.

Notogaster. Dorsosejugal furrow concave medially, with forward protruding humeral part. True condyles absent. Notogastral surface without foveolae, whole surface distinctly punctate (Fig. 11). This feature is very conspicuous. Ten pairs of erect, needle-shaped notogastral setae, all finely aciculate. Setae c_2 only hardly shorter than setae *la*, however, the end of the latter thinner than in setae c_2. Setae in posterior part of notogaster slightly longer than reamaining ones (Fig. 8).

Lateral part of podosoma (Fig. 10). Tutorium short, slightly curved. Lateral part of prodorsum foveolate.

Ventral parts (Fig. 9). Apodemes and borders in anterior part of epimeral region well developed, mostly straight. Sternal apodeme between the sejugal and apodemes 2 with double lines, similar formation present in front of *ap*. 2 (Fig. 9). Epimeral setae short and simple, setae *1c* arising far posteriorly. Surface of ventral plate finely punctate. Genital and aggenital setae short, anal



Figures 8–11. *Pseudotocepheus atolanaro* sp. n. – 8 = body in dorsal view, 9 = body in ventral view, 10 = body in lateral view, 11 = notogastral sulpture. **Figure 12**. *Pseudotocepheus tolanaro* Mahunka, 1997, notogastral sculpture

and adanal ones much longer. Lyrifissures *iad* in preanal position.

Legs. Type of ultimate setae: L-L-L-L. Tarsi of legs II-IV with dorsal tooth.

Remarks. On the basis of the form and ratio of notogastral setae as well as the lateral pattern of the prodorsum, the new species is closest to *Pseudotocepheus tolanaro* Mahunka, 1997. However, it is distinguished from the latter species by the form of distal part of lamellae (conspicuously curved in *tolarano*), by the curved exobothridial setae (straight in *tolanaro*), by the ratio of notogastral setae (setae c_2 much shorter than setae *la* in *tolanaro*), and also by the pattern of the notogaster: rarely punctate in the new species (Fig. 11), ornamented by much bigger foveolae in *tolanaro* (Fig. 12).

Etymology. Named after its related species.

***Multioppia malalatinae* sp. n.**

(Figs. 13–15)

Diagnosis. Rostral part wide, rounded. Lamellar setae located far from each other. A short lamellar costula medially present bearing lamellar setae. Three pairs of small, interbothridial maculae, irregular in size. Interlamellar setae minute. Bothridium with narrow posterior lobe, a longitudinal crest directed posteriorly from it. Sensillus long, with lanceolate head. Twelve pairs of notogastral setae variously lengths present, setae c_2 represented only by their alveoli. Exobothridial surface with longitudinal crest, partly granulate. Sternal region well sclerotised, sejugal apodemes with a pair of rounded tubercles. Epimeral setae varying in lengths. Five pairs of genital setae. Anal setae and lyrifissures *iad* in typical position.

Material examined. Holotype: Malagasy Republic, Vohimana Reserve, primary forest. 17. 04. 2008. Leg. Cs. Csuzdi (Afr-996). 1 paratype from the same sample. Holotype (1794-HO-09) and 1 paratype (1794-PO-09) deposited in HNHM.

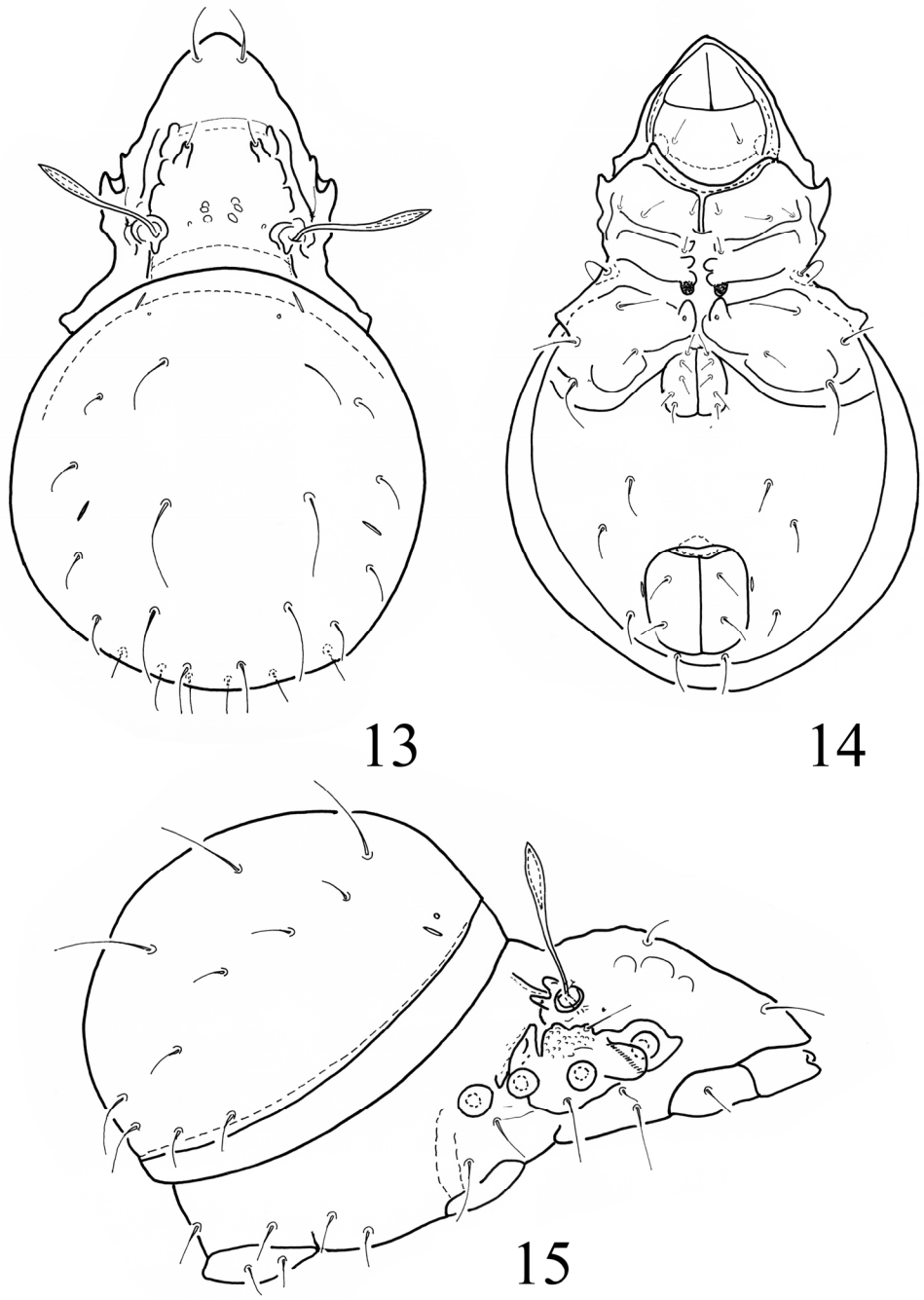
Measurements. Length of body: 280–297 μm, width of body: 171–182 μm, height of body: 192 μm.

Prodorsum. Wide, rostral part triangular, rostral apex rounded. Prodorsal surface with short costulae medially, directed inwards, bearing short lamellar setae. In front of costulae weak, transversal crests and some large lateral maculae present laterally. Three pairs of conspicuously small, irregular median maculae, and a very short, hardly visible interlalmellar setae present. Exobothridial setae longer than the lamellar or interlamellar ones, arising on tubercles. Bothridium small, with narrow posterior lobe. A pair of posterior longitudinal laths, directed to the anterior margin of notogaster also visible (Fig. 13). Sensillus with long peduncle and a gradually dilated, lanceolate head. Its surface nearly smooth, some minute aciculae on it distal end.

Notogaster. Dorsosejugal part distinct. Form of notogaster conspicuously high, semicircular. Anterior notogastral margin round, crista or humeral apophyses absent. Twelve pairs of notogastral setae different length present, setae c_2 represented only by their alveoli. Four inner pairs of setae (*da*, *dm*, *dp*, and h_1) much longer than the outer pairs (*la, lm, lp* and h_2, h_3. All setae finely roughened.

Lateral part of podosoma. Pedotecta I small, rounded, pedotecta II minute, hardly visible. Exobothridial region with short longitudinal crest (Fig. 15).

Ventral parts (Fig. 14). Epimeral region with well developed sculpture. Sternal apodema short, not touching apodemes 2. Sejugal apodemes wide, with a distinct pair of tubercles medially, a pair much weaker tubercles in opposite position. Apodemes 4 also wide, with well curved posteriorly. Discidium large. Epimeral setae varying in lengths, setae *1a*, *1c*, *2a*, *3a* and *4a* much shorter than the others. Setae *3c* and *4b* longest of all. Genitoanal setal formula: 5-1-2-3. Genital setae, exceptionally setae g_4 –g_5 originatin far from each other. Lyrifisures *iad* in paraanal position.



Figures 13–15. *Multioppia malalatinae* sp. n. – 13 = body in dorsal view, 14 = body in ventral view, 15 = podosoma in lateral view

Remarks. The new species may well be characterised by the notogastral setae of different length and the form of the sensillus. On the basis of these characters it is well distinguished from all related taxa.

Etymology. I dedicate the new species to Malalatina Razafindrakoto (IRD, Antananarivo) for her help during the fieldtrip in Madagascar.

***Oxyoppia (Oxyoppia) tuberosa* sp. n.**

(Figs. 16–18)

Diagnosis. With the characters of *Oxyoppia*. Basal parts of costulae converging, their anterior parts slightly shorter, running anteriorly in parallel position. Transcostula absent. Two pairs of maculae and one pair of large tubercles present in interlamellar region. Bothridium with posterior lobe. Sensillus long, setiform, covered by bristles. Anterior margin of notogaster with a longitudinal median crest and a pair of very large humeral condyles. Ten pairs of bacilliform notogastral setae. Epimeral setae simple, apodemes well developed. Six pairs of genital setae and a pair of long adanal fissures in direct apoanal position.

Material examined. Holotype: Malagasy Republic, Vohimana Reserve, primary forest. 17. 04. 2008. Leg. Cs. Csuzdi (Afr-996). 1 paratype from the same sample. Holotype (1795-HO-09) and 1 paratype (1795-PO-09) deposited in HNHM.

Measurements. Length of body: 222–230 μm, width of body: 123–130 μm.

Prodorsum. Prodorsal surface well granulate, its anterior part covered with larger, basal part with smaller granules. Rostrum conical, rostral apex narrowed. Costulae well developed, wide, comprising two parts. Basal parts running from bothridium slightly longer than the apical ones, basal parts strongly converging, apical ones parallel. Apices of costulae rounded, wide. Interlamellar region with two pairs of rounded maculae and one pair of large tubercles. Rostral setae longest of all, finely ciliate. Lamellar and interlamellar setae short, simple, Exobothridial setae minute. Bothridium large, with wide posterior lobe. Sensillus long, well curved inwards, setiform, covered with bristles.

Notogaster. Anterior margin of notogaster with one pair of robust humeral condyles and an unpaired median crest directed backwards (Fig. 16). Ten pairs of notogastral setae thin, bacilliform, with blunt tip. All setae nearly equal in length, only setae c_2, p_2 and p_3 shorter than the other setae.

Lateral part of podosoma. With well-developed, distinctly dissected longitudinal crest. A part of this surface also granulate (Fig. 18).

Ventral parts (Fig. 17). Sternal region with well developed apodemes, all together composing a closed network. Sternal apodemes with a small round hollow anteriorly. Epimeral surface mostly smooth, lateral part of epimeres 1–2 and mental tectum finely granulate, similar to prodorsal surface. All epimeral setae simple, smooth. Epimeral setal formula: 3-1-3-3. Ventral plate smooth. Genital opening much smaller than the anal one. Genital, aggenital and anal setae simple setiform, adanal setae bacilliform. Genitoanal setal formula: 6-1-2-3. Lyrifissures *iad* conspicuously long, located in direct apoanal position.

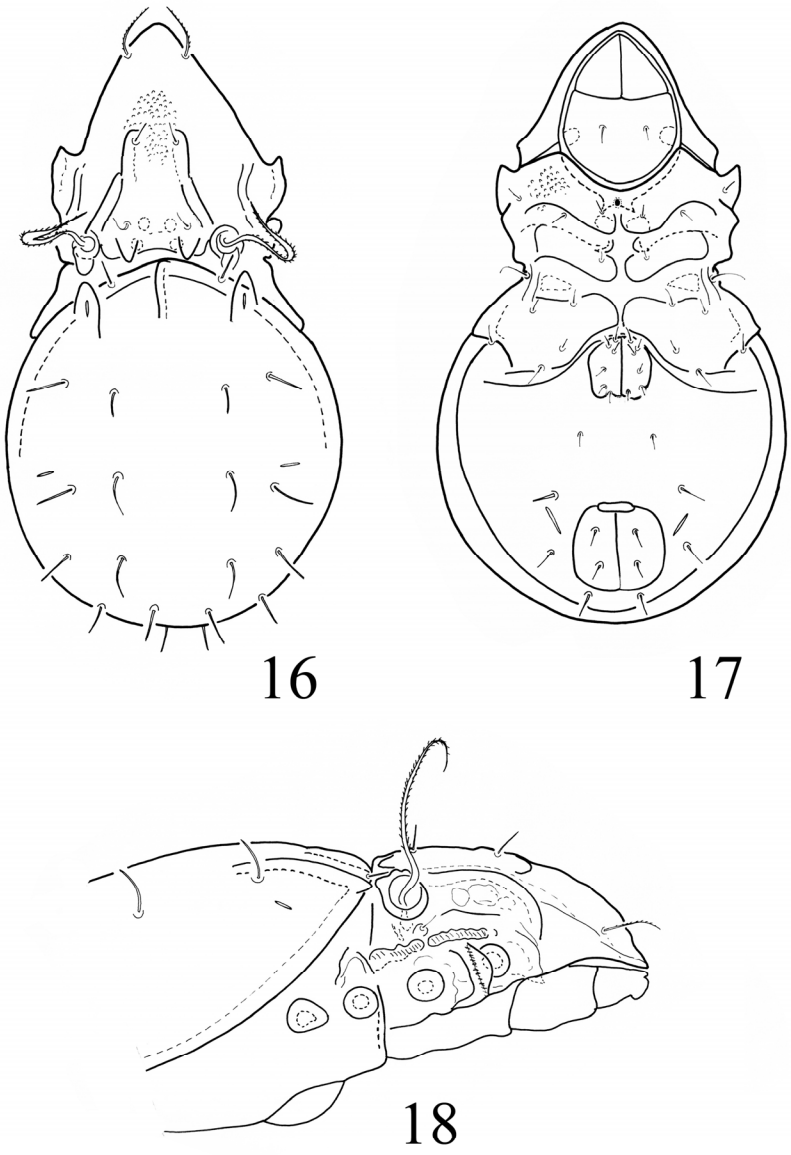
Legs. With the characters of *Oxyoppia* species.

Remarks. The new species is well charaterised by the form of the costula, the presence of the interbothridial tubercles, the form of the sensillus, the very large humeral condyles of the notogaster and by the the form of anal lyrifissure. This combination of features was previously unknown in the family.

Etymology. The name refers to the presence of a pair of large tubercles in the interbothridial region.

***Madabelba* gen. n.**

Diagnosis. Family Suctobelbidae. Rostral apex wide with deep median incision. No tooth or inci-



Figures 16–18. *Oxyoppia* (*Oxyoppia*) *tuberosa* sp. n. – 16 = body in dorsal view, 17 = body in ventral view, 18 = podosoma in lateral view

sure in rostral region. Tectopedial field reduced, paratectopedial field absent. A well developed lamellar knob continued in an interbothridial conspicuous crists. Bothridial lobe wide, with 2 apices. Sensillus long, lanceolate. 4 notogastral condyles present, both pairs connected with eachother. Nine pairs of simple notogastral setae. Epimeral region well sclerotised, postepimeral fossa absent. Four pairs of genital setae. Aggenital and ad_3 setae arising in the same level.

Type species: *Madabelba bercziki* sp. n.

Remarks. Form of the rostrum, the prodorsal sculpture, and the bothridial lobe combined with

the number of genital setae as a feature combination has been unknown in the family Suctobelbidae. On this basis the new genus is well distinguishable from all other genera of the family.

Madabelba bercziki sp. n.

(Figs. 19–21)

Diagnosis. See the diagnosis in the description of the new genus.

Material examined. Holotype: Malagasy Republic, Vohimana Reserve, primary forest. 17. 04. 2008. Leg. Cs. Csuzdi (Afr-996). 3 paratypes from the same sample. Holotype (1796-HO-09) and 2 paratypes (1796-PO-09) deposited in HNHM, 1 paratype in MHNG.

Measurements. Length of body: 220–243 μm, width of body: 140–158 μm.

Prodorsum. Rostral part wide, rostrum with deep, U-shaped incisure medially. Rostral tooth and true incisure absent, only a thin lateral line present. Rostral rib absent anteromedian part of prodorsum without sculpture, inner frame of the tectopedial field absent. Lamellar knob large, long, connected with interbothridial field peculiarly (Fig. 19). Bothridium large with wide, bifurcate bothridial lobe. Prebothridial rib short. Rostral setae with distinct bristles, with long curved distal end. Lamellar, interlamellar and exobothridial setae fine and short. Peduncle of sensillus very long, its head lanceolate.

Notogaster. Dorsosejugal region with two pairs of large condyles resembling two large condyles with double apices. Lateral ones with long crest, directed posteriorly. Notogastral sigillum absent. Nine pairs of notogastral setae present, all simple, comparatively short.

Lateral part of podosoma. Rostral part of prodorsum conspicuously high. Lateral part of the prodorsum with polygonate pattern. Exobothridial arch weakly developed, without strong crest. Exobothridial region distinctly punctate. Pedotecta I large, rounded, its surface with polygonate pattern. Around the acetabulum of leg III a serrate border present (Fig. 21)..

Ventral parts (Fig. 20). Epimeral borders and apodemes normally developed, a wide sternal field present between epimeral plates medially. Epimera IV with slightly undulate posterior border. Epimeral setae short and fine, setae *1c* located laterally on pedotecta I. Genital aperture wide, not smaller than anal one. Anogenital setal formula 4-1-2-3. All setae in ventral region nearly equal in length, setae ad_3 arising far from each other, near to the lateral margin of ventral plate.

Remarks. See the "Remarks" after the genital diagnosis.

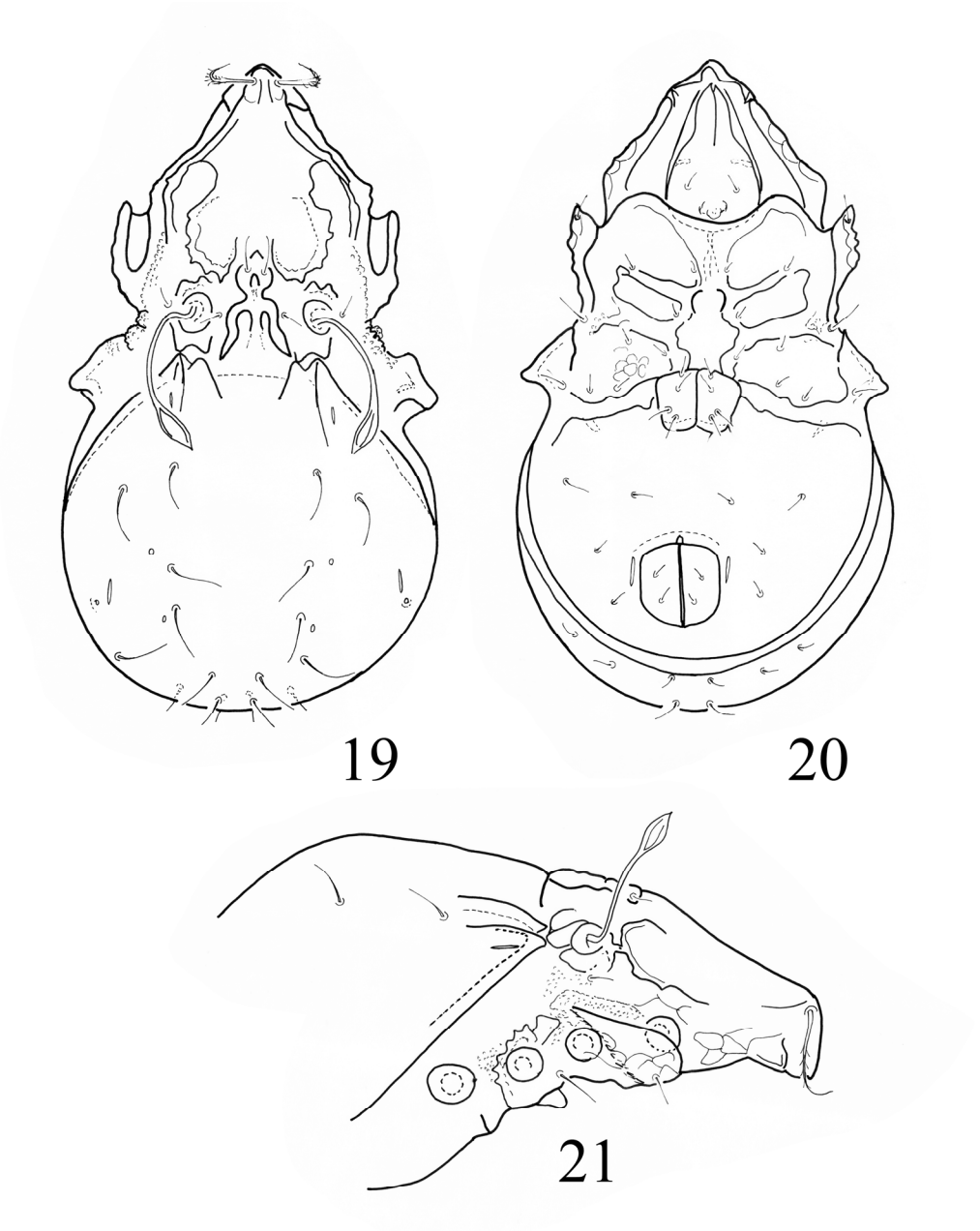
Etymology. I dedicate this species to my friend, Dr Árpád Berczik, well-known hydrobiologist, professor emeritus at the Eötvös Loránd University on the occasion of his 80th birthday.

Protoripoda nasuta sp. n.

(Figs. 22–23)

Diagnosis. Rostral part wide, rostral apex nasiform, besides its two embayments. Lamellae short, with blunt apices bearing well developed lamellar setae. Rostral setae broken, interlamellar setae medium long, directed outwards. Sensillus partly covered by the protruding pteromorpha. Dorsosejugal furrow absent medially. Large, anteriorly rounded, protruding pteromorphae. Notogaster with ten pairs well developed setae and four pairs of sacculi. Epimeral setae simple, minute or absent (broken?). Epimeral borders and apodemes weakly developed. Anogenital setal formula 4-0(1?)-2-2. Anterior adanal setae arising far anteriorly.

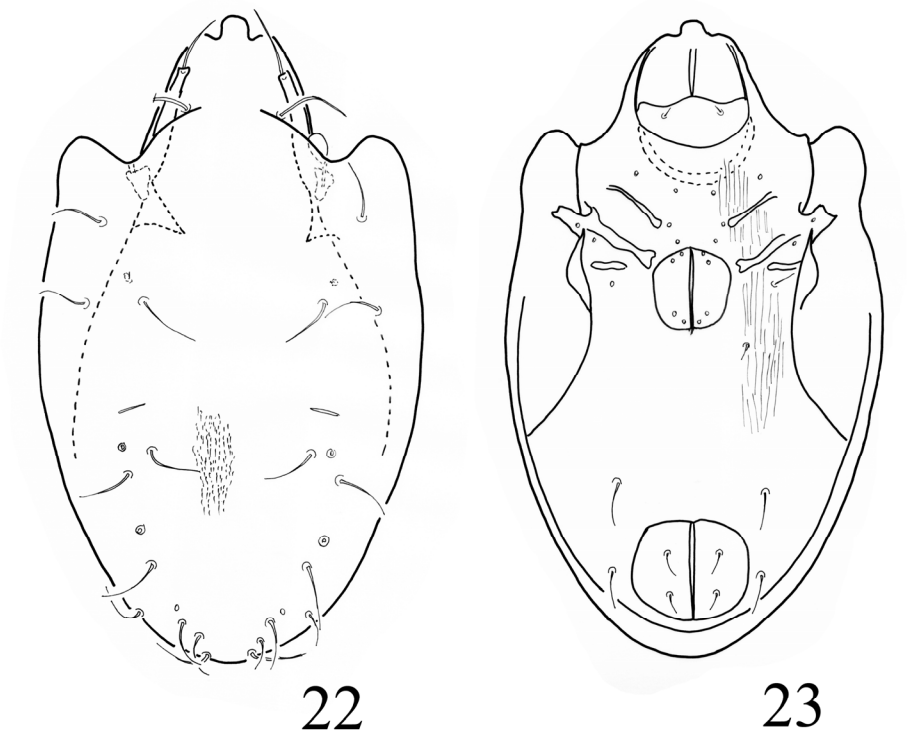
Material examined. Holotype: Malagasy Republic, Vohimana Reserve, primary forest. 17. 04. 2008. Leg. Cs. Csuzdi (Afr-996). 2 paratypes from the same sample. Holotype (1797-HO-09) and 1 paratype (1797-PO-09) in HNHM, 1 paratype in MHNG.



Figures 19–21. *Madabelba bercziki* gen. et sp. n. – 19 = body in dorsal view, 20 = body in ventral view, 21 = podosoma in lateral view

Measurements. Length of body: 296 μm, width of body: 181 μm.

Prodorsum. Rostral part wide, rostral apex projected forwards, comparatively large, rounded, nasiform. Lamellae short, narrow, lamellar cusp straight, slightly dilated bearing strong lamellar setae. They reach over the rostral apex. Very narrow prelamellae present, at their distal end with the insertion of the broken setae. Interlamellar setae much shorter, spiniform, directed outwards, finely roughened. Bothridium and basal part of sensillus covered by the notogaster. Itst head finely aciculate (Fig. 22).



Figures 22–23. *Protoripoda nasuta* sp. n. 22 = body in dorsal view, 23 = body in ventral view

Notogaster. Dorsosejugal furrow strongly convex, running to the insertion of interlamellar setae, gradually narrowed, and absent medially. Pteromorphae very large, rounded, protruding anteriorly, auriculate. Its margin conspicuously strong. Notogastral surface nearly smooth anteriorly, with rather scattered punctures or irre gular alveoli arranged in ribs. Ten pairs of setiform notogastral setae, nearly equal in length. Four pairs of round sacculi. Lyrifissures *im* well observable in front of setae *lp* and h_3. Posteromarginal setae shorter than the anterior ones.

Lateral part of podosoma. Pedotecta I large, pedotecta II much smaller.

Ventral parts (Fig. 23). Epimeral and ventral plates ornamented by irregular, or mostly irregular scratches. Epimeral setae minute or represented only by their alveoli. Pedotecta II directed slightly forwards, their posterior part with sharply pointed spur. Discidium well developed, with spiniform anterior custodium. Apodemes are typical for the genus. Genitoanal setal formula: 4-1-2-2. Genital setae minute or represented by their alveoli, aggenital setae missing in one side, adanal setae much longer than anal setae.

Legs. Legs tri- and heterodactylous.

Remarks. On the basis of the number of genital setae the new species belongs to the genus *Protoripoda* Balogh, 1970. The new species is well characterised by the striking shape of its rostrum, a feature which has previously been unknown in this genus and the related *Calobates* Balogh, 1961species.

Etymology. The species name refers to the nasiform apex.

Acknowledgements – First of all I should like to thank the collector, Dr. Csaba Csuzdi, for the very interesting material and his assistance in preparing this manuscript. My thanks are due also to my wife, Mrs. Luise Mahunka-Papp for preparing the drawings. Last, but not least, I thank Dr. Lajos Zombori for reviewing the English text.

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Opusc. Zool. Budapest, 2009, 40 (2): 103–105

First record of the genus *Atrichops* Verrall, 1909 in Hungary (Diptera: Athericidae)

D. MURÁNYI[1], N. TARJÁNYI[2] and K. SCHÖLL[3]

Abstract. This paper reports on the first known larva of *Atrichops crassipes* (Meigen, 1820) from Hungary. The single specimen was caught with flushing of stones during a year-long monthly sampling in the Morgó Stream, Börzsöny Mts. Characterisation of the sampling site, list of the accompanying fauna and a figure on the habitus of the specimen are given.

Among the small family Athericidae, there are only two species included in the Checklist of the Diptera of Hungary (Papp, 2001). The monotypic genus *Atrichops* Verrall, 1909 was mentioned as expected but not yet reported (Májer, 2001).

Atrichops crassipes (Meigen, 1820) is known from the United Kingdom, Belgium, The Netherlands, Spain, France, Germany, Italy, Czech Republic, Poland, Slovakia and Romania (Thomas, 2004), and having a merolimnic, biennial life cycle (Gerke & Böttger, 2001).

During a year-long monthly benthic sampling in the Morgó Stream, North Hungary, a single larva of *Atrichops* was caught with flushing of stones. This specimen represents the first Hungarian record of the genus.

MATERIAL AND METHODS

Benthic samples were taken monthly at five localities along the Morgó Stream (called Apátkuti Stream on its upper section), between 06. 03. 2008 and 03. 02. 2009. Two samples were taken at each locality: one with flushing of stones, and one with kick-and-sweep method. The material has been preserved in 70% ethanol. The *Atrichops* specimen is deposited in the Diptera Collection, Department of Zoology, Hungarian Natural History Museum, Budapest (HNHM).

The accompanying benthic taxa were identified to specific level by various specialists: Mollusca: Dávid Murányi; Crustacea: Gammaridae: Júlia Papp (Eötvös Loránd University); Ephemeroptera: Nóra Hordós (ELU), Dávid Murányi; Odonata: Dávid Murányi; Plecoptera: Dávid Murányi; Coleoptera: Zoltán Kálmán, Zoltán Csabai (University of Pécs); Neuroptera: Dávid Murányi; Diptera: Simuliidae: Csaba Deák (Trans-Tisza Region Inspectorate for Environment, Nature and Water). Additional taxa were identified only at generic or family level (e.g. Oligochaeta: Tubificidae; Diptera: Ceratopogonidae), or the identifications are still in progress (e.g. Trichoptera, Diptera: Chironomidae).

RESULTS AND DISCUSSION

*Material examined***.** *Atrichops crassipes* (Meigen, 1820): Hungary, Pest county, Börzsöny Mts, Kismaros, Morgó Stream above the bridge of the forest railway terminal, N 47°49.751' E 19° 00.777', 200 m a.s.l., flushing of stones, 28. 10. 2008, one larva, leg. K. Schöll, and N. Tarjányi.

The specimen is a third instar larva, on the basis of the size of head capsule (Gerke & Böttger

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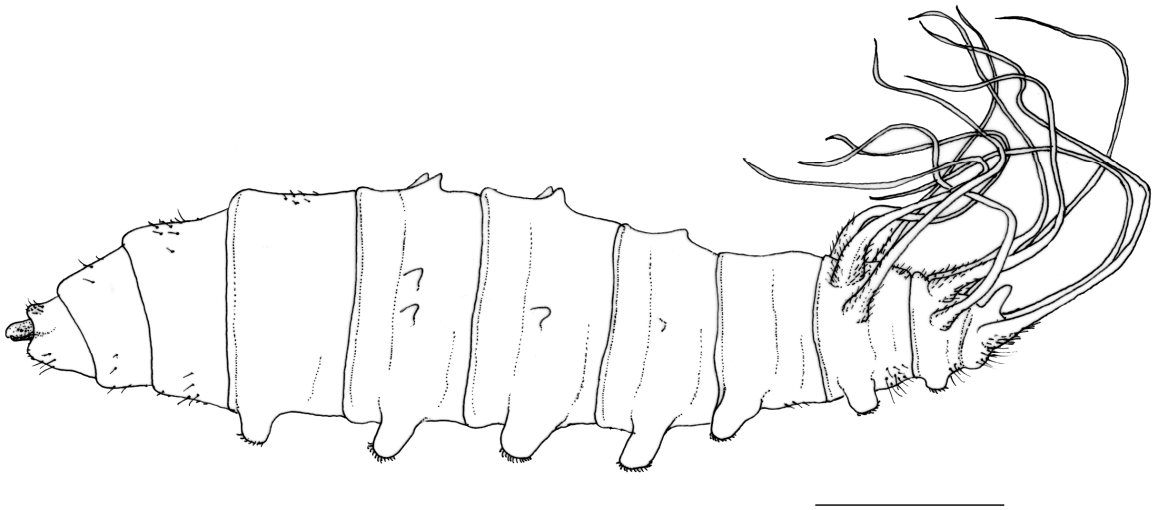

Figure 1. Habitus of the larva of *Atrichops crassipes* (Meigen, 1820) from Morgó Stream, Hungary (scale 1 mm)

2001). Its habitus (Fig. 1) possesses all the distinctive morphological characteristics of the species discussed by Thomas (1974), Rozkošný (1980) and Rozkošný and Nagatomi (1997).

The sampling site, where the larva was caught, is the lowest among the five sites along the Morgó Stream, 1 km above the mouth to the Danube River. The width of the stream is about 3 m, the water is 0.2–0.5 m deep and runs fast; the substrate consists of sand with sparse, 5–15 cm large stones, macrophyton is lacking, and the bank is moderately steep. The stream flows among alders, and thus the water is rather shaded. The sampling site agrees with locality 7 of Csuták (1973).

The accompanying benthic macroinvertebrata fauna consists of the following taxa: Mollusca: *Ancylus fluviatilis* Müller, 1774*, Pisidium sp.*; Crustacea: Amphipoda: *Gammarus balcanicus* Schäferna, 1922, *Gammarus fossarum* Koch, 1853, *Gammarus roeseli* Gervais, 1835; Ephemeroptera: *Baetis rhodani* (Pictet, 1843), *Baetis* sp., *Caenis luctuosa* (Burmeister, 1839), *C. robusta* Eaton, 1884, *Ecdyonorus* spp*., Ephemera danica* (Müller, 1764), *Ephemerella ignita* (Poda, 1761), *Habroleptoides* sp*., Habrophlebia* sp*., Rhitrogena* spp.; Odonata: *Calopteryx virgo* (Linnaeus, 1758), *Onychogomphus forcipatus* (Linnaeus, 1758); Plecoptera: *Capnia bifrons* (Newman, 1839), *Isoperla* sp*., Leuctra* sp*., Nemoura* sp.; Coleoptera: Elmidae: *Elmis maugetii* (Latreille, 1802), *Limnius volckmari* (Panzer, 1793); Trichoptera (indet.); Diptera: Limoniidae (indet.); Diptera: Ceratopogonidae: *Atrichopogon* sp.; Diptera: Chironomidae (indet.); Diptera: Simuliidae: *Prosimulium tomosvaryi* (Enderlein, 1921), *Prosimulium* sp*., Simulium (Simulium) argyreatum* (Meigen, 1838), *Simulium (Simulium) argyreatum/variegatum, Simulium (Simulium) ornatum* (Meigen, 1818); Diptera: Athericidae: *Ibisia marginata* (Fabricius, 1781).

The species should be regarded very rare in the Morgó Stream, as only a single larva turned up among the thousands of benthic invertebrates collected. Moreover, it was not found during previous benthic samplings (Csuták, 1973; Lien, 1984), nor extensive recent collecting efforts of Diptera imagos in the watershed of the Morgó Stream (Papp, 2004, 2006, 2007). It is worth to mention that other Athericidae larvae (probably all of them are *Ibisia marginata* [Fabricius, 1781], but some young larvae cannot be identified with sure) were present and quite abundant at all but one sampling sites.

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Checklist of the planktonic rotifer fauna in the active floodplain area of the Danube (1843-1806, 1669 and 1437-1489 rkm)

K. SCHÖLL[1] and A. KISS[1]

Abstract. A checklist of Rotifera containing 84 taxa from the main arm and the active floodplain of the River Danube is provided. *Beauchampiella eudactylota* Gosse, 1886; *Brachionus forficula forficula* (Wierzejski, 1891); *Brachionus quadridentatus mirabilis* (Daday, 1897) and *Conochilus dossuarius dossuarius* (Hudson, 1875) are new to the fauna of th Danube. *Brachionus angularis aestivus* Skorikov, 1914; *Brachionus budapestiensis punctatus* (Hempel, 1896) and *Filinia passa* (O. F. Müller, 1786) are new to the Hungarian section of the Danube.

INTRODUCTION

This checklist is a result of a long-term (2001–2008) zooplankton investigation concentrating on three parts of the Hungarian Danube section: Szigetköz (1843–1806 rkm), Göd (1669 rkm) and Gemenc (1437–1489 rkm) in the main-arm and the active floodplain. The whole Hungarian section of the Danube is part of the Middle Danube Basin which covers a large area reaching from the Gate of Devin near Bratislava to the Iron Gate between Serbia and Romania. Unique side branch systems, oxbows, marshes and large floodplain forests enrich the natural value of this stretch.

The first research about the rotifer fauna of the Danube was carried out by Tóth (1861) at Budapest), and Bartsch (1877) at Gemenc. In the second half of the 20th century, Kertész (1963) investigated the whole Hungarian section of the Danube, while particular investigations were carried out at Gemenc by Kol and Varga (1960).

In the Szigetköz Area (1850–1793 rkm) our investigations on rotifers started in 2003. Before this period, Gulyás worked on the planktonic rotifers of the Danube above of Budapest and in the Szigetköz area (Gulyás, 1987, 1990, 1994 a, 1994 b, 1994 c, 1996, 1997). In the 1990s significant hydrological and morphological changes occurred on the Szigetköz Danube stretch mainly due to the construction of the Dunakiliti water reservoir and the regulation of the river. The active connection between the abandoned Danube stretch and the side-arm system in the floodplain disappeared and the water supply of the protected floodplain was materialized through the artificial water recharge system. Consequently, the artificial water recharge system, the water flow and the connection with the main river have become permanent in most of the side arms while individual characteristics, special phytoplankton and zooplankton assemblages are disappearing.

The investigations of Rotifers in the Hungarian Danube Research Station at Göd (GOD - 1669 rkm) started in 2006.

The Gemenc floodplain lies between the 1498th and 1469th river-kilometres of the River Danube and it is an integral part of the Hungarian Danube-Dráva National Park. The floodplain (30 km long and 5–10 km wide) is one of the largest in Europe with an area of 18,000 hectares (Natura 2000). It contains various characteristic side arms and backwaters which are in different conditions. As a result of the regulations of the Middle-Danube in the 19th century, the length of the riverbed decreased, and its shape became stabilized. The increased flow velocity at the shortened reach of the river caused significant erosion in the riverbed, which led to the drying up of the floodplains and the weakening of the lateral interactions (Guti,

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2001). In order to acquire more knowledge of the ecological and hydrobiological functions of the floodplains, the Hungarian Danube Research Station of the Hungarian Academy of Sciences has started the Gemenc Research Project, which also covers the investigation of Rotifer assemblages (Dinka *et al.,* 2006; Schöll & Kiss, 2008; Schöll *et al,* 2008; Schöll, 2009).

MATERIALS AND METHODS

In the Szigetköz and the main arm at Göd (GOD – 1669 rkm) sampling has been carried out 3 or 4 times a year (usually May, July, August and October) since 2003 up to the present. Since 2001 in the Gemenc area sampling has been taken usually 4 or 5 times a year, but the number of sampling sites vary according to their hydrological situation.

Samples were collected from the surface using a plankton net (mesh size: 40 μm) filtering 20 L of water. Samples were preserved in a solution of 4% formalin, but live specimens were also collected to identify illoricate species. Koste (1978) and the nomenclature of Segers (2007) were used for species identification.

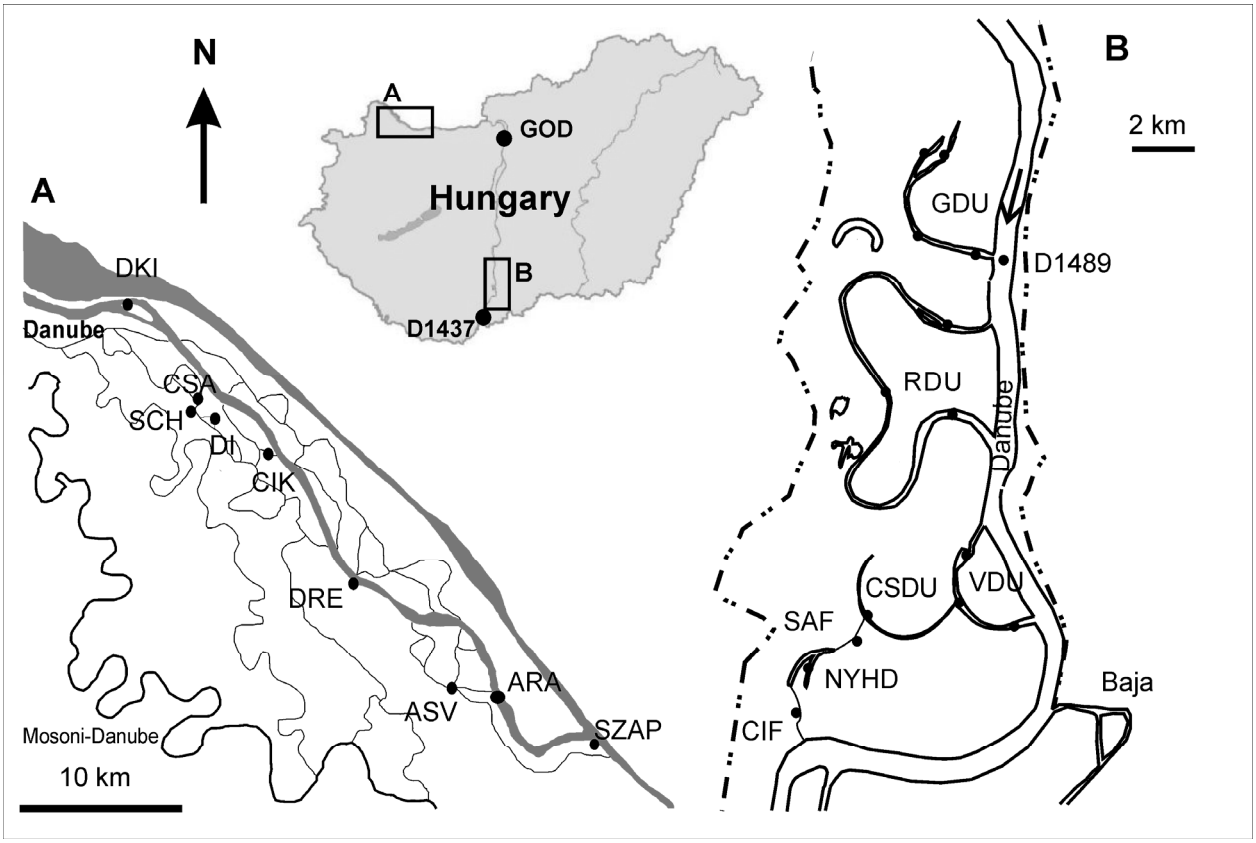

Figure 1. The sampling sites along the Hungarian reach of the Danube. A: Szigetköz floodplain; B: Gemenc floodplain

SAMPLING SITES WITH THE GPS COORDINATES AND SAMPLING DATES

1. Main arm of the Danube (Fig. 1 A)

1843 rkm, Dunakiliti (DKI) N47°59,738', E17° 18,927'. – The direct action site of the river bottom ramp. The sampling site is directly situated above the river bottom tramp.

2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 13. 10.), 2005 (12. 07., 28. 09.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

1825 rkm, Dunaremete (DRE) N47°52,993' E17°27,404'. – Approximately 350 meter wide regulated bed, with rip-raps. The average flow velocity of the water is 1.9–2.2 m sec $^{-1}$. The level of the water is permanently lower than 1% (30–60 cm) since the diversion of the Danube.

2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 13. 10.), 2005 (12. 07., 28. 09.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

1811 rkm, Szap (SZAP) N47°49,290' E17° 36,391'. – Deep (7–8 m) dredging river section because of the navigation. Rip-raps on the riverbank with breakwater on the right bank of the river.

2004 (24. 06., 16. 08., 13. 10.).

1806 rkm, bridge at Medve (MED) N47° 25,433' E17°08,137'. – The site is situated below the bridgehead on the right bank of the Danube.

2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

1669 rkm, Göd (GOD) N47°40,816' E19°-07,543'. – The average wide of the Danube at Göd is 450 m, the average depth is 4.5 m. The substratum of the riverbed is small gravelly. The coast-defence with rip-raps. The flow velocity at medium water is 1–1.2 m sec^{-1}.

2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 13. 10.), 2005 (12. 07., 28. 09.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

1489 rkm, Érsekcsanád (D1489) N46°16,403' E18°54,547'. – In front of the mouth of Grébeci-Holt-Duna. Flow velocity at medium water 0.8-1.2 m sec^{-1}.

2001 (29.08), 2002 (08. 04., 03. 07.), 2003 (07. 05., 08. 07., 15. 09. 27. 10.), 2004 (04. 14., 27. 05., 01. 07., 26. 08., 27. 10.), 2007 (23. 05., 11. 09., 25. 09.)

1437 rkm, Mohács (D1437) N45º55,967' E18º 46,433'. – Beyond the harbour of the ferry.

2007 (25. 07., 29. 08., 25. 10.), 2008 (18. 03., 10. 06.).

2. Szigetköz floodplain (Fig. 1 A)

Schisler-holtág /Schisler-oxbow/ (SCH) N47° 57,260' E17°21,640'. – Approximately 500 m long and 40–50m wide stagnant water side-arm relic with plesiopotamal characteristics. Until the diversion of the Danube the water supply of the oxbow was during the higher floods alone. In autumn of 1992 the connection of the oxbow with the arms of the active floodplain was broken because of the water level depression of the side-arms. Following this only leaking water received particularly from the direction of the Zátonyi-Duna. In 1997 in the frame of habitat reconstruction project direct connection was established with the Csákányi-Duna through a channel.

2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 14. 09., 13. 10.), 2005 (12. 07., 28. 09., 13. 10.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

Csákányi-Duna (CSA) N47°57,333' E17° 21,-636'. – The most widest and open water arm of the Cikolai branch system. Before the diversion of the Danube at median water was characterised by 1-3 water depth, moderate water flow and gravel bed. After the diversion of the Danube in 1992 this section was nearly completely dried. Presently the water supply of the Csákányi-Duna is realized by the Kormosi side-arm and Doborgazi closure.

2003 (13. 05., 22. 07., 10. 09., 30. 10.), 2004 (24. 06., 16. 08., 14. 09., 13. 10.), 2005 (12. 07., 28. 09., 13. 10), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.), 2008 (20. 05., 07. 07., 08. 10.).

Cikolai-ág /Cikolai-arm/ (CIK) N47°55,964' E17°24,452'. Nearly 120–150 m wide branch stretch with moderate water flow. This side-arm is the section of the Cikolai branch-system was locked up by cut-off. The water level is higher by several meters than the lower side of the closure.

2005 (12. 07., 28. 09.), 2006 (04. 07., 26. 09.), 2007 (17. 04., 09. 07., 16. 10.).

Disznós-ág /Disznós-arm/ (DI) N47°57,050' E17°22,056'. – Side-arm with parapotamal characteristics in the upper part of the Cikolai-branch system.

2004 (14. 09.), 2005 (13. 10.)

Ásványi-Duna (ASV) N47°50,314' E18° 31,-243'. – 1–3 m depth, gravel-bed and permanent flowing branch stretch along the Árvai closure.

2003 (14.05., 11.09., 30.10.), 2004 (24. 06., 16. 08., 13. 10.), 2005 (12. 07., 28. 09.), 2006 (04.07., 26.09.), 2007 (17.04., 10.07., 17.10.).

3. Gemenc floodplain (Fig. 1 B)

Grébeci-Duna (GDU) N46°17,202' E18° 52,-921'. – Side arm with plesiopotamal characteristics, it was the part of the main arm until the interception in 1895–1896.

2002 (08. 04., 02. 05., 13. 06., 03. 07., 12. 11.), 2003 (07. 05., 08. 07., 15. 09. 27. 10.), 2004 (04. 14., 27. 05., 01. 07., 26. 08., 27. 10.), 2007 (23. 05., 11. 09., 25. 09.).

Rezéti-Duna (RDU) N46°14,767' E18°52,541'. – Parapotamal side-arm, one time it was the main arm until the interception in 1893-1894.

2002 (08. 04., 02. 05., 13. 06., 03. 07., 12. 11.), 2003 (07. 05., 08. 07., 15. 09. 27. 10.), 2004 (04. 14., 27. 05., 01. 07., 26. 08., 27. 10.), 2007 (23. 05., 11. 09., 25. 09.).

Vén-Duna (VDU) N46°12,118' E18° 53,843'. – Parapotamal side arm, it was the part of the main arm until the interception in 1897-1898.

2002 (08. 04., 02. 05., 13. 06., 03. 07., 12. 11.), 2003 (07. 05., 08. 07., 15. 09. 27. 10.), 2004 (04. 14., 27. 05., 01. 07., 26. 08., 27. 10.), 2007 (23. 05., 11. 09., 25. 09.)

Nyéki-Holt-Duna (NYHD) N46°11,355' E18° 50,749'. – Paleopotamal oxbow with dense macrovegetation.

2003 (07. 05., 08. 07., 15. 09.), 2004 (27. 05., 01. 07.).

Cserta-Duna (CSDU) N46°11,783' E18°53,-053' – Plesiopotamal side arm of the Vén-Duna (VDU).

2003 (07. 05., 27. 10.), 2007 (25. 09.).

Sárkány-fok (SAF) N46°11,816' E18°51,594'. – Narrow channel between the NYHD and the Cserta-Duna.

2003 (07. 05., 08. 07., 15. 09.).

Címer-fok (CIF) N46°46,781' E18°50,723'. – Narrow channel between the NYHD and the main arm of the Danube.

2003 (07. 05.)

4. Béda-Karapancsa floodplain

Külső-Béda (BDU) N45º55,767’ E18º45,420’. – Plesiopotamal side arm.

2007 (25. 07., 29. 08., 25. 10.), 2008 (18. 03., 10. 06.)

RESULTS

Aneuropsis fissa (Gosse, 1851)

Main arm: DRE 07.07.2008., GOD 17.04.2004., 21.08. 2001., D1489 11.09.2007., D1437 25.10.2007, 18.03.2008. **Szigetköz floodplain:** CSA 14.04.2007. **Gemenc floodplain:** GDU 25.09.2007., 29.07.2008, RDU 11.09.2007, 25.09.2007, VDU 25.09.2007. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 29.08.2007.

Ascomorpha ovalis (Bergendal, 1892)

Main arm: D1489 13.06.2002. **Gemenc floodplain:** GDU 13.06.2002., 03.07.2002., VDU 13.06.2002.

Asplanchna brightwelli Gosse, 1850

Main arm: D1489 02.05.2002. **Gemenc floodplain:** GDU 02.05.2002., 13.06.2002., 12.11.2002., 27.05.2004., 01.07.2004., 26.08.2004., 29.07.2008., RDU 29.08.2001., 02.05.2002., 03.07.2002., 07.05.2003., 01.07.2004., 26.08.2004., 29.07.2008., VDU 29.08.2001., 01.07.2004., 26.08.2004.

Asplanchna girodi De Guerne, 1888

Szigetköz floodplain: SCH 12.10.2004., 20.05.2008. **Gemenc floodplain:** GDU 20.09.2002., 07.05.2003., 16.09.2003., RDU 20.09.2002., 16.09.2003., 27.10.2003., 27.10.2004., VDU 07.05.2003., 16.09.2003., 01.07.2004.

Asplanchna sieboldi (Leydig, 1854)

Gemenc floodplain: GDU 03.07.2002., 29.10.2004., RDU 29.08.2001., 03.07.2002., VDU 29.08.2001., 03.07.2002.

Asplanchnopus multiceps (Schrank, 1793)

Gemenc floodplain: RDU 25.09.2007. **Béda-Karapancsa floodplain:** BDU 25.10.2007.

Beauchampiella eudactylota Gosse, 1886

Gemenc floodplain: NYHD 08.07.2003.

Brachionus angularis angularis Gosse, 1851

Main arm: DKI 17.04.2007., 20.05.2008., 07.07.2008., DRE 17.04.2007., 20.05.2008., 07.10.2008., ASV 14.05.2003., 11.07.2005., MED 17.04.2007., 20.05.2008., GOD 21.06.2006., 27.09.2006., 17.04.2007., 23.05.2007., 21.05.2008., 07.07.2008., D1489 03.07.2002., 20.09.2002., 26.08.2004., 23.05.2007., D1437 25.07.2007., 29.08.2007. **Szigetköz floodplain:** SCH 14.05.2003., 12.10.2004., 17.04.2007., 16.10.2007., 07.07.2008., CSA 16.08.2004., 11.07.2005., 17.04.2007., 07.07.2008., 07.10.2008., CIK 04.07.2006., 17.04.2007. **Gemenc floodplain:** GDU 03.07.2002., 23.05.-2007., 11.09.2007., 25.09.2007., 29.07.2008., RDU 29.08.-2001., 13.06.2002., 03.07.2002., 20.09.2002., 12.11.2002., 07.05.2003., 16.09.2003., 27.05.2004., 01.07.2004., 14.04.-2004., 23.05.2007., 11.09.2007., 25.09.2007., VDU 29.08.-2001., 03.07.2002., 20.09.2002., 07.05.2003., 14.04.2004., 27.05.2004., 23.05.2007., 11.09.2007., 25.09.2007., CSDU 25.09.2007., SAF 08.07.2003., 13.09.2003., NYHD 06.05.-2003., 15.09.2003., 27.05.2004. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 29.08.2007., 25.10.2007., 18.03.-2008., 10.06.2008.

Brachionus angularis aestivus Skorikov, 1914

Gemenc floodplain: GDU 08.04.2002., RDU 08.04.-2002., 02.05.2002., NYHD 01.07.2004.

Brachionus angularis bidens Plate, 1886

Main arm: DKI 17.04.2007., DRE 17.04.2007., 20.05.2008., GOD 21.05.2008., 07.07.2008., D1489 02.05.2002., 13.06.2002., 07.05.2003., 23.05.2007. **Szigetköz floodplain:** SCH 07.07.2008., CSA 17.04.2007., 07.07.-2008., CIK 07.04.2006., 17.04.2007. **Gemenc floodplain:** GDU 08.04.2002., 02.05.2002., 13.06.2002., 20.09.2002., 12.11.2002., 14.04.2004., 01.07.2004., 29.10.2004., RDU 29.08.2001., 08.04.2002., 02.05.2002., 13.06.2002., 03.07.-2002., 07.05.2003., 08.07.2003., 14.04.2004., 26.08.2004., 27.10.2004., 23.05.2007., 25.09.2007., VDU 08.04.2002., 02.05.2002., 13.06.2002., 07.05.2003., 08.07.2003., 16.09.-2003., 01.07.2004., 25.09.2007., CSDU 27.10.2003., NYHD 06.05.2003., 08.07.2003., 27.10.2004.

Brachionus budapestiensis budapestiensis Daday, 1885

Main arm: DRE 20.05.2008., D1489 08.07.2003., D1437 13.06.2002., 18.03.2008. **Szigetköz floodplain:** CIK 04.07.2006., 16.10.2007. **Gemenc floodplain:** GDU 13.06.2002., 03.07.2002., 01.07.2004., 25.09.2007., RDU 29.08.2001., 03.07.2002., 25.09.2007., VDU 29.08.2001., 03.07.2002., 08.07.2003. **Béda-Karapancsa floodplain:** BDU 18.03.2008.

Brachionus budapestiensis punctatus (Hempel, 1896)

Gemenc floodplain: RDU 29.08.2001., VDU 29.08.2001.

Brachionus calyciflorus amficeros Ehrenberg, 1838

Main arm: DRE 17.04.2007. **Gemenc floodplain:** RDU 29.08.2001., VDU 29.08.2001.

Brachionus calyciflorus anuraeiformis Brehm, 1909

Main arm: DKI 14.05.2003., 24.06.2004., 16.08.2004., 20.05.2008., DRE 20.05.2008., MED 20.05.2008., GOD 21.6.2006., D1489 02.05.2002., 03.07.2002., 20.09.2002., 27.05.2004., 01.07.2004., 23.05.2007., D1437 25.07.2007., 18.03.2008. **Szigetköz floodplain:** SCH 17.04.2007., 10.07.2007., 16.10.2007., 20.05.2008., CSA 10.07.2007., CIK 17.04.2007., ASV 14.05.2003. **Gemenc floodplain:** GDU 08.04.2002., 02.05.2002., 13.06.2002., 07.05.2003., 14.04.2004., 29.10.2004., 11.09.2007., 25.09.2007., 29.07.2008., RDU 29.08.2001., 08.04.2002., 02.05.2002., 13.06.2002., 03.07.2002., 20.09.2002., 07.05.2003., 08.07.2003., 14.04.2004., 27.05.2004., 01.07.2004., 26.08.2004., 27.10.2004., 23.05.2007., 11.09.2007., 25.09.2007., 29.07.2008., VDU 29.08.2001., 08.04.2002., 02.05.2002., 13.06.2002., 03.07.2002., 20.09.2002., 07.05.2003., 08.07.2003., 14.04.2004.,

27.05.2004., 01.07-2004., 26.08.2004., 23.05.2007., 25.09. 2007., CSDU 25.09.2007., SAF 08.07.2003. NYHD 27.10. 2004. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 25. 10.2007., 10.06.2008.

Brachionus calyciflorus calyciflorus Pallas, 1766

Main arm: DKI 17.04.2007., DRE 17.04.2007., D1489 29.08.2001., D1437 26.08.2004., 25.07.2007., 18.03.2008. **Szigetköz floodplain:** SCH 17.04.2007., 10.07.2007., 16.10. 2007., 20.05.2008., ASV 17.04.2007. **Gemenc floodplain:** GDU 11.09.2007., 25.09.2007., RDU 29.08.2001., 02.05. 2002., 16.09.2003., 23.05.2007., 11.09.2007., 25.09.2007., VDU 29.08.2001., 23.05.2007., 25.09.2007., CSDU 25.09. 2007. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 25. 10.2007., 10.06.2008.

Brachionus calyciflorus dorcas Gosse, 1851

Main arm: D1489 08.04.2002., 03.07.2002., 07.05.2003. **Gemenc floodplain:** GDU 03.07.2002., 16.09.2003., RDU 08.04.2002., 20.09.2002., VDU 08.04.2002., 13.06.2002., 20. 09.2002., 07.05.2003., 08.07.2003., 16.09.2003., SAF 08.07. 2003., NYHD 06.05.2003., 15.09.2003.

Brachionus calyciflorus spinosus Wierzejski, 1891

Main arm: D1489 29.08.2001., 07.05.2003. **Gemenc floodplain:** GDU 08.04.2002., 14.04.2004., 27.05.2004., RDU 08.04.2002., 27.05.2004., VDU 29.08.2001., 08.04. 2002., 07.05.2003., 14.04.2004., 26.08.2004.

Brachionus diversicornis diversicornis (Daday, 1883)

Main arm: D1489 01.07.2004., 29.07.2008., D1437 25.07.2007., 23.08.2007. **Szigetköz floodplain:** SCH 12.10. 2004., ASV 11.09.2003., 04.07.2006. **Gemenc floodplain:** GDU 13.06.2002., 03.07.2002., 07.05.2003., 16.09.2003., 27.05.2004., 01.07.2004., 26.08.2004., 11.09.2007., 25.09. 2007., 29.07.2008., RDU 29.08.2001., 13.06.2002., 03.07. 2002., 16.09.2003., 26.08.2004., 01.07.2004., 11.09.2007., 25.09.2007., VDU 29.08.2001., 13.06.2002., 16.09.2003., 26.08.2004., 01.07.2004., 11.09.2007., 25.09.2007., NYHD 01.07.2004. **Béda-Karapancsa floodplain:** BDU 25.10. 2007., 10.06.2008.

Brachionus diversicornis homoceros Wierzejski, 1891

Gemenc floodplain: RDU 08.07.2003. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 29.08.2007.

Brachionus falcatus Zacharias, 1898

Main arm: D1489 08.07.2003. **Szigetköz floodplain:** CIK 09.07.2007. **Gemenc floodplain:** GDU 25.09.2007., RDU 16.09.2003., 26.08.2004., VDU 16.09.2003., 26.08.2004.

Brachionus forficula forficula (Wierzejski, 1891)

Main arm: D1489 29.07.2008., D1437 25.07.2007., 29.08.2007. **Gemenc floodplain:** GDU 11.09.2007., 29.07. 2008., RDU 25.09.2007., VDU 11.09.2007., NYHD 01.07. 2004. **Béda-Karapancsa floodplain:** BDU 25.07.2007., 29. 08.2007., 10.06.2008.

Brachionus leydigi leydigi Cohn, 1862

Gemenc floodplain: RDU 07.05.2003., VDU 07.05. 2003., 23.05.2007.

Brachionus leydigi tridentatus (Sernov, 1901)

Gemenc floodplain: VDU 27.05.2004.

Brachionus plicatilis plicatilis (O. F. Müller, 1786)

Gemenc floodplain: RDU 16.09.2003.

Brachionus quadridentatus cluniorbicularis (Skorikov, 1894)

Main arm: D1489 29.08.2001., 08.04.2002., 02.05. 2002., 03.07.2002., 07.05.2003., 08.07.2003., 16.09.2003., 14.04.2004., 23.05.2007., D1437 18.03.2008., 10.06.2008. **Szigetköz Floodplain:** ASV 14.05.2003., 16.08.2004. **Gemenc floodplain:** GDU 08.04.2002., 02.05.2002., 13.06. 2002., 03.07.2002., 16.09.2003., 11.09.2007., 29.07.2008., RDU 29.08.2001., 02.05.2002., 03.07.2002., 12.11.2002., 07.05.2003., 16.09.2003., 14.04.2004., 27.05.2004., 26.08. 2004., 23.05.2007., VDU 29.08.2001., 02.05.2002., 13.06. 2002., 03.07.2002., 07.05.2003., 08.07.2003., 16.09.2003., 14.04.2004., 27.05.2004., 26.08.2004., 23.05.2007., 25. 09.2007., CSDU 27.10.2003., NYHD 26.08.2004. **Béda-Karapancsa floodplain:** BDU 18.03.2008., 10.06.2008.

Brachionus quadridentatus brevispinus (Ehrenberg, 1832)

Main arm: D1489 03.07.2002. **Gemenc floodplain:** RDU 02.05.2002., 13.06.2002., 16.09.2003., VDU 16.09. 2003.

Brachionus quadridentatus mirabilis (Daday, 1897)

Gemenc floodplain: NYHD 08.07.2003.

Brachionus urceolaris urceolaris (O. F. Müller, 1773)

Gemenc floodplain: RDU 14.04.2004., VDU 14.04. 2004.

Cephalodella catellina (O. F. Müller, 1786)

Gemenc floodplain: RDU 11.09.2007.

Colurella colurus (Ehrenberg, 1830)

Gemenc floodplain: SAF 06.05.2003.

*Colurella obtusa (*Gosse, 1886*)*

Szigetköz floodplain: CSA 20.05.2008.

Conochilus dossuarius dossuarius (Hudson, 1875)

Main arm: D1489 03.07.2002.

Epiphanes macrorourus (Barrois et Daday, 1894)

Gemenc floodplain: VDU 16.09.2003.

Euchlanis deflexa (Gosse, 1851)

Gemenc floodplain: CSDU 25.09.2007.

Euchlanis dilatata Ehrenberg, 1832

Main arm: DKI 2008.05.20, DRE 20.05.2008., 07. 10.2008. **Szigetköz floodplain:** SCH 10.09.2003., 26.09. 2006., 16.10.2007., 07.10.2008., CSA 16.08.2004., DI 26. 09.2006., ASV 16.08.2004. **Gemenc floodplain:** GDU 02.05.2002., 25.09.2007., RDU 16.09.2003., 27.05.2004., 01. 07.2004., VDU 01.07.2004., CSDU 27.10.2003., 25.09. 2007., SAF 13.09.2003., NYHD 27.05.2004., 01.07.2004.

Euchlanis triquetra Ehrenberg, 1838

Gemenc floodplain: NYHD 08.07.2003.

Filinia cornuta (Weisse, 1847)

Gemenc floodplain: GDU 14.04.2004., NYHD 27.10. 2004.

Filinia longiseta longiseta Ehrenberg, 1834

Main arm: D1489 08.07.2003. **Gemenc floodplain:** GDU 13.06.2002., RDU 29.08.2001., 08.07.2003., VDU 29.08.2001. **Béda-Karapancsa floodplain:** BDU 10.06. 2008.

Filinia passa (O. F. Müller, 1786)

Gemenc floodplain: SAF 08.07.2003., NYHD 13.09. 2003.

Filinia terminalis (Plate, 1886)

Main arm: DKI 16.08.2004., MED 17.04.2007., GOD 05.07.2006., D1489 02.05.2002., 07.05.2003. **Gemenc floodplain:** GDU 08.04.2002., 02.05.2002., 12.11.2002., 07.05. 2003., 14.04.2004., 27.05.2004., 25.09.2007., RDU 08.04. 2002., 02.05.2002., 12.11.2002., 07.05.2003., 14.04.2004., VDU 08.04.2002., 02.05.2002., 03.07.2002., 20.09.2002., 07. 05.2003., 27.10.2003., 27.05.2004., 23.05.2007., CSDU 06. 05.2003.

Hexarthra mira (Hudson, 1871)

Gemenc floodplain: VDU 13.06.2002.

Kellicottia longispina Kellicott, 1879

Szigetköz floodplain: SCH 20.05.2008. **Gemenc floodplain:** VDU 02.05.2002.

Keratella cochlearis cochlearis (Gosse, 1851)

Main arm: DKI 14.05.2003., 11.09.2003., 04.07.2006., 17.04.2007., 10.07.2007., 16.10.2007., 20.05.2008., DRE 17. 04.2007., 10.07.2007., MED 04.07.2006., 17.04.2007., 20. 05.2008., 07.10.2008., GOD 08.11.2006., 29.11.2006., 17.04.2007., 23.05.2007., 26.09.2007., 21.05.2008., D1489 08.04.2002., 13.06.2002., 03.07.2002., 20.09.2002., 07.05. 2003., 08.07.2003., 27.10.2003., 14.04.2004., 27.05.2004., 01.07.2004., 23.05.2007., 11.09.2007., 25.09.2007., 29.07. 2008., D1437 25.07.2007., 25.10.2007., 10.06.2008. **Szigetköz floodplain:** SCH 14.05.2003., 10.09.2003., 29.10.2003., 24.06.2004., 16.08.2004., 04.07.2006., 26.09.2006., 17.04. 2007., 10.07.2007., 16.10.2007., 20.05.2008., 07.07.2008., 07.10.2008., CSA 16.08.2004., 11.07.2005., 26.09.2006., 17.04.2007., 10.07.2007., 20.05.2008., 07.10.2008., CIK 28. 09.2005., 17.04.2007., 09.07.2007., 16.10.2007., DI 26.09. 2006., ASV 14.05.2003., 30.10.2003., 24.06.2004., 12. 07.2005., 28.09.2005. **Gemenc floodplain:** GDU 08.04. 2002., 13.06.2002., 20.09.2002., 12.11.2002., 07.05.2003., 16.09.2003., 14.04.2004., 27.05.2004., 01.07.2004., 26.08. 2004., 27.10.2004., 23.05.2007., 11.09.2007., 25.09.2007., 29.07.2008., RDU 29.08.2001., 08.04.2002., 13.06.2002., 20.09.2002., 12.11.2002., 07.05.2003., 08.07.2003., 16.09. 2003., 27.10.2003., 14.04.2004., 27.05.2004., 01.07.2004., 26.08.2004., 27.10.2004., 23.05.2007., 11.09.2007., 25.09. 2007., 29.07.2008., VDU 29.08.2001., 08.04.2002., 13.06. 2002., 20.09.2002., 12.11.2002., 07.05.2003., 08.07.2003., 16.09.2003., 14.04.2004., 27.05.2004., 01.07.2004., 26.08. 2004., 27.10.2004., 23.05.2007., 11.09.2007., 25.09.2007., CSDU 06.05.2003., 27.10.2003., 25.09.2007., SAF 08.07. 2003., 13.09.2003., NYHD 06.05.2003., 08.07.2003., 13.09. 2003., 27.05.2004., 01.07.2004., 26.08.2004., CIF 06.05. 2003. **Béda-Karapancsa floodplain:** BDU 29.08.2007., 25. 10.2007., 18.03.2008., 10.06.2008.

Keratella cochlearis macracantha (Lauterborn, 1900)

Main arm: DKI 29.10.2003., 12.10.2004., 17.04.2007., 10.07.2007., DRE 12.10.2004., D1489 02.05.2002, 20.09. 2002. **Szigetköz floodplain:** SCH 12.10.2004., 04.07.2006., 26.09.2006., CSA 12.10.2004., ASV 17.04.2007. **Gemenc floodplain:** GDU 02.05.2002., 13.06.2002., 12.11.2002., 07.05.2003., RDU 29.08.2001., 02.05.2002, 13.06.2002., 03. 07.2002., 07.05.2003., VDU 08.04.2002., 02.05.2002, 07.05. 2003., 01.07.2004., CSDU 27.10.2003., NYHD 06.05.2003.

Keratella cochlearis robusta (Lauterborn, 1900)

Gemenc floodplain: GDU 12.11.2002., RDU 12.11. 2002., VDU 12.11.2002.

Keratella cochlearis tecta (Lauterborn, 1900)

Main arm: DKI 14.05.2003., 04.07.2006., 10.07.2007., 16.10.2007., DRE 04.07.2006., 26.09.2006., 20.05.2008., GOD: 21.06.2006., 08.11.2006., 06.12.2006., 23.05.2007., 21.05.2008., D1489 29.08.2001., 13.06.2002., 03.07.2002., 20.09.2002., 07.05.2003., 08.07.03., 27.10.2003., 27.05. 2004., 01.07.2004., 26.08.2004., 23.05.2007., 25.09.2007., 29.07.2008., D1437 25.07.2007., 29.08.2007., 25.10.2007., 10.06.2008., MED 04.07.2006., 26.09.2006., 16.04.2007., 20. 05.2008. **Szigetköz floodplain:** SCH 14.05.2003., 16.08. 2004., 04.07.2006., 26.09.2006., CSA 16.08.2004., 05.07. 2006., 26.09.2006., 10.07.2007., CIK 04.07.2006., DI 05.07. 2006., 26.09.2006., ASV 14.05.2003., 30.10.2003., 16.08. 2004., 10.07.2007. **Gemenc floodplain:** GDU 02.05.2002., 13.06.2002., 20.09.2002., 12.11.2002., 07.05.2003., 14.04. 2004., 27.05.2004., 01.07.2004., 26.08.2004., 27.10.2004., 23.05.2007., 11.09.2007., 25.09.2007., 29.07.2008., RDU 29.08.2001., 02.05.2002., 13.06.2002., 03.07.2002., 20.09. 2002., 12.11.2002., 07.05.2003., 08.07.2003., 16.09.2003., 27.10.2003., 14.04.2004., 27.05.2004., 01.07.2004., 26.08. 2004., 27.10.2004., 23.05.2007., 11.09.2007., 25.09.2007., 29.07.2008., VDU 29.08.2001., 08.04.2002., 02.05.2002, 13. 06.2002., 03.07.2002., 20.09.2002., 07.05.2003., 08.07. 2003., 27.10.2003., 14.04.2004., 27.05.2004., 01.07.2004., 26.08.2004., 27.10.2004., 23.05.2007., 11.09.2007., 25.09. 2007., CSDU 06.05.2003., 27.10.2003., 25.09.2007., SAF 06.05.2003., 13.09.2003., NYHD 06.05.2003., 08.07.2003., 15.09.2003., 27.05.2004., 01.07.2004., 26.08.2004., CIF 06.05.2003. **Béda-Karapancsa floodplain:** BDU 25.07. 2007., 29.08.2007., 25.10.2007., 18.03.2008., 10.06.2008.

Keratella irregularis connectens (Lauterborn, 1900)

Main arm: MED 07.10.2008., D1489 08.04.2002. **Gemenc floodplain:** GDU 08.04.2002., RDU 29.08.2001., 08.04.2002., 01.07.2004., VDU 29.08.2001., 08.04.2002., NYHD 26.08.2004.

Keratella quadrata quadrata (O. F. Müller, 1786)

Main arm: DKI 14.05.2003., 17.04.2007., DRE 20.05.2008., SZAP 16.08.2004., MED 17.04.2007., GOD 21.05.2008., D1489 02.05.2002, 14.04.2004., 23.05.2007., D1437 10.06.2008. **Szigetköz floodplain:** SCH 14.05.2003., 04.07.2006., 17.04.2007., 16.10.2007., 20.05.2008., CSA 17. 04.2007., CIK 16.10.2007., DI 05.07.2006., ASV 14.05. 2003. **Gemenc floodplain:** GDU 08.04.2002., 02.05.2002., 12.11.2002., 07.05.2003., 14.04.2004., 27.05.2004., 01.07. 2004., 27.10.2004., 23.05.2007., 11.09.2007., RDU 29.08. 2001., 08.04.2002., 02.05.2002., 12.11.2002., 07.05.2003., 27.10.2003., 14.04.2004., 27.05.2004., 27.10.2004., 25.09. 2007., 29.07.2008., VDU 29.08.2001., 08.04.2002., 02.05. 2002., 13.06.2002., 20.09.2002., 12.11.2002., 07.05.2003., 08.07.2003., 14.04.2004., 27.05.2004., 23.05.2007., CSDU 06.05.2003., NYHD 06.05.2003. **Béda-Karapancsa floodplain:** BDU 25.10.2007., 18.03.2008., 10.06.2008.

Keratella quadrata frenzeli (Eckstein, 1895)

Gemenc floodplain: RDU 27.05.2004., VDU 27.10. 2004.

Keratella testudo testudo (Ehrenberg, 1832)

Gemenc floodplain: CIF 06.05.2003.

Keratella tropica tropica (Apstein, 1907)

Gemenc floodplain: GDU 26.08.2004., RDU 29.08. 2001., 16.09.2003., 26.08.2004., VDU 29.08.2001., 16.09. 2003., 29.07.2008., NYHD 06.05.2003.

Keratella valga valga (Ehrenberg, 1834)

Main arm: DRE 12.10.2004. **Gemenc floodplain:** GDU 14.04.2004., RDU 27.05.2004., VDU 14.04.2004., 27.05. 2004., 23.05.2007.

Lecane luna (O. F. Müller, 1776)

Szigetköz floodplain: SCH 14.05.2003., CIK 10.07. 2007., DI 06.07.05, 06.09.26. **Gemenc floodplain:** RDU 27. 05.2004., 01.07.2004., VDU 01.07.2004., SAF 06.05.2003., NYHD 06.05.2003., 08.07.2003., 27.05.2004.

Lecane lunaris (Ehrenberg, 1832)

Main arm: GOD 21.05.2008. **Szigetköz floodplain:** SCH 16.10.2007., 07.10.2008. **Gemenc floodplain:** GDU 25.09.2007., RDU 25.09.2007., 29.07.2008.

Lecane ungulata (Gosse, 1887)

Gemenc floodplain: SAF 13.09.2003., NYHD 08.07. 2003.

Lecane quadridentata (Ehrenberg, 1832)

Gemenc floodplain: NYHD 08.07.2003.

Lepadella patella (O. F. Müller, 1786)

Main arm: DKI 24.06.2004., SZAP 16.08.2004., D1489 23.05.2007., D1437 10.06.2008. **Szigetköz floodplain:** CSA 29.10.2003., CIK 11.09.2003., SCH 24.06.2004., 16.04.2007. **Gemenc floodplain:** RDU 23.05.2007., 11.09.2007., VDU 29.08.2001., CSDU 25.09.2007., SAF 06.05.2003., 08.07. 2003., 13.09.2003., NYHD 01.07.2004., 26.08.2004.

Microcodon clavus Ehrenberg, 1830

Gemenc floodplain: CSDU 27.10.2003.

Monommata longiseta (O. F. Müller,1786)

Gemenc floodplain: SAF 13.09.2003. **Béda-Karapancsa floodplain:** BDU 25.10.2007.

Mytilina mucronata mucronata (O. F. Müller, 1773)

Main arm: GOD 06.12.2006. **Gemenc floodplain:** RDU 25.09.2007., SAF 06.05.2003., 08.07.2003.

Mytilina ventralis macracantha (Gosse, 1886)

Szigetköz floodplain: SCH 24.06.2004., CIK 16.10. 2007.

Notholca labis labis Gosse, 1887

Main arm: D1489 14.04.2004. **Szigetköz floodplain:** CSA 17.04.2007. **Gemenc floodplain:** RDU 02.05.2002., 14.04.2004., VDU 14.04.2004.

Notholca acuminata (Ehrenberg, 1832)

Gemenc floodplain: GDU 14.04.2004., RDU 07.05. 2003., VDU 07.05.2003., SAF 06.05.2003.

Notholca squamula (O. F. Müller, 1786)

Main arm: D1489 14.04.2004. **Gemenc floodplain:** RDU 14.04.2004.

Platyias patulus (O. F. Müller, 1786)

Gemenc floodplain: NYHD 01.07.2004.

Polyarthra dolichoptera Idelson, 1925

Main arm: DKI 14.05.2003., 16.10.2007., DRE 20.05. 2008., MED 20.05.2008., GOD 21.06.2006., 22.11.2006., 21. 05.2008., 07.07.2008., D1489 02.05.2002., 08.07.2003., 16.09.2003., 27.05.2004., 23.05.2007. **Szigetköz floodplain:** SCH 14.05.2003., 10.09.2003., 16.08.2004., 12.10.2004., 28. 09.2005., 04.07.2006., 05.07.2006., 26.09.2006., 16.10. 2007., 20.05.2008., 07.07.2008., 07.10.2008., CSA 16.08. 2004., 17.04.2007., 07.10.2008., CIK 04.07.2006., DI 26.09. 2006., ASV 14.05.2003., 16.08.2004. **Gemenc floodplain:** GDU 07.05.2003., 16.09.2003., 27.05.2004., 01.07.2004., 26. 08.2004., 27.10.2004., 25.09.2007., 29.07.2008., RDU 07.05. 2003., 16.09.2003., 14.04.2004., 27.05.2004., 01.07.2004., 27.10.2004., 25.09.2007., 29.07.2008., VDU 07.05.2003., 08.07.2003., 16.09.2003., 14.04.2004., 27.05.2004., 01.07. 2004., 23.05.2007., 25.09.2007., 29.07.2008., CSDU 06.05. 2003., 25.09.2007., NYHD 06.05.2003., 08.07.2003., 27.05.2004. **Béda-Karapancsa floodplain:** BDU 25.07. 2007., 29.08.2007., 25.10.2007., 18.03.2008., 10.06.2008.

Platyias longiremis Carlin, 1943

Main arm: DRE 07.10.2008., GOD 02.11.2006., 23.05.2007., D1489 29.08.2001., 08.04.2002., 07.05.2003., 01.07.2004. **Szigetköz floodplain:** SCH 04.07.2006., 26.09. 2006., 07.07.2008., 07.10.2008., CSA 26.09.2006., ASV 14. 05.2003. **Gemenc floodplain:** Gemenc: GDU 08.04.2002., 02.05.2002., 13.06.2002., 12.11.2002., 07.05.2003., 16.09. 2003., 14.04.2004., 25.09.2007., RDU 29.08.2001., 08.04. 2002., 02.05.2002., 13.06.2002., 03.07.2002., 07.05.2003., 16.09.2003., 14.04.2004., 27.05.2004., 27.10.2004., 23.05. 2007., 25.09.2007., VDU 29.08.2001., 08.04.2002., 02.05. 2002., 13.06.2002., 03.07.2002., 12.11.2002., 07.05.2003., 16.09.2003., 14.04.2004., 27.05.2004., 26.08.2004., CSDU 27.10. 2003., SAF 06.05.2003., 08.07.2003., NYHD 06.05. 2003., 13.09.2003. **Béda-Karapancsa floodplain:** BDU 25.10.2007.

Platyias maior Bruckhardt, 1900

Main arm: D1489 08.07.2003. **Szigetköz floodplain:** SCH 16.08.2004., 04.07.2006., 26.09.2006., CSA 05.07. 2006. **Gemenc floodplain:** GDU 13.06.2002., 27.10.2004., CSDU 25.09.2007.

Platyias minor Voigt, 1904

Main arm: D1489 01.07.2004. **Gemenc floodplain:** RDU 29.07.2008., NYHD 08.07.2003.

Platyias vulgaris Carlin, 1943

Main arm: DKI 11.09.2003., 26.09.2006., 17.04.2007., 07.10.2008., GOD 23.05.2007., D1489 02.05.2002., 13.06. 2002., 03.07.2002., 20.09.2002., 26.08.2004. **Szigetköz floodplain:** SCH 05.07.2006., 17.04.2007., 10.07.2007., CSA 07.10.2008. CIK 17.04.2007. **Gemenc floodplain:** GDU 02.05.2002., 13.06.2002., 03.07.2002., 20.09.2002., 12. 11.2002., RDU 29.08.2001., 02.05.2002., 13.06.2002., 03.07. 2002., 20.09.2002., 12.11.2002., 11.09.2007., 25.09.2007., VDU 29.08.2001., 02.05.2002., 13.06.2002., 03.07.2002., 20.09.2002., 11.09.2007., CSDU 06.05.2003., 27.10.2003., SAF 08.07.2003., NYHD 08.07.2003., CIF 06.05.2003.

Scaridium longicaudum (O. F. Müller, 1786)

Szigetköz floodplain: CSA 16.08.2004., SCH 07.-10.2008., CIK 11.09.2003. **Gemenc floodplain:** VDU 25. 09.2007., NYHD 08.07.2003., 01.07.2004.

Synchaeta grandis Zacharias, 1893

Szigetköz floodplain: SCH 08.10.07. **Gemenc floodplain:** GDU 25.09.2007., RDU 25.09.2007., 29.07. 2008., NYHD 08.07.2003., CIF 06.05.2003., CSDU 27.10. 2003.

Synchaeta longipes Gosse, 1887

Main arm: GOD 11.07.2007., D1489 20.09.2002. **Szigetköz floodplain:** SCH 17.04.2007. **Gemenc floodplain:** VDU 20.09.2002. **Béda-Karapancsa floodplain:** BDU 18.03.2008.

Synchaeta oblonga Ehrenberg, 1832

Main arm: MED 08.05.20. **Gemenc floodplain:** GDU 23.05.2007., 25.09.2007., RDU 25.09.2007., 29.07.2008., CSDU 25.09.2007.

Synchaeta pectinata Ehrenberg, 1832

Main arm: GOD 21.06.2006., 23.05.2007., D1489 08.04.2002., 02.05.2002. **Szigetköz floodplain:** DI 26. 09.2006. **Gemenc floodplain:** GDU 08.04.2002., 02.05. 2002., 13.06.2002., 12.11.2002., RDU 29.08.2001., 27.10. 2004., VDU 08.04.2002., 02.05.2002.

Synchaeta stylata Wierzejski, 1893

Gemenc floodplain: VDU 29.08.2001., 08.07.2003.

Synchaeta tremula (O. F. Müller, 1786)

Main arm: DRE 07.04.17, GOD 06.06.21, D1489 02.05.02, 02.06.13, 04.08.26. **Szigetköz floodplain:** SCH 08.10.07, CSA 07.04.17. **Gemenc floodplain:** GDU 08.04.2002., 02.05.2002., 12.11.2002., 25.09.2007., RDU 29. 08.2001., 08.04.2002., 02.05.2002., 13.06.2002., 20.09. 2002., 12.11.2002., 27.10.2003., 01.07.2004., 27.10.2004., 25.09.2007., VDU 29.08.2001., 08.04.2002., 02.05.2002., 13.06.2002., 20.09.2002., 12.11.2002., 27.10.2003., 25.09. 2007., CSDU 27.10.2003., 25.09.2007., SAF 13.09.2003.

Taphrocampa annulosa Gosse, 1851

Gemenc floodplain: NYHD 08.07.2003.

Testudinella patina (Hermann, 1783)

Gemenc floodplain: RDU 27.10.2004.

Trichocerca longiseta (Schrank, 1802)

Szigetköz floodplain: SCH 10.09.2003.

Trichocerca birostris (Minkiewitz, 1900)

Main arm: GOD 05.07.2006. **Szigetköz floodplain:** SCH 12.10.2004., 16.10.2007. **Gemenc floodplain:** GDU 26.08.2004., 29.07.2008., RDU 29.08.2001., 25.09.2007., NYHD 27.05.2004. **Béda-Karapancsa floodplain:** BDU 25.10.2007.

Trichocerca pusilla (Lauterborn, 1898)

Szigetköz floodplain: SCH 04.06.24. **Gemenc floodplain:** GDU 13.06.2002., RDU 03.07.2002., 11.09.2007., VDU 13.06.2002., 08.07.2003., 01.07.2004., CSDU 27.10.2003., NYHD 08.07.2003.

Trichocerca rattus (O. F. Müller, 1776)

Main arm: D1489 08.07.2003., D1437 25.07.2007. **Gemenc floodplain:** GDU 29.07.2008., VDU 08.07.2003., NYHD 08.07.2003. **Béda-Karapancsa floodplain:** BDU 25. 07.2007.

Trichotria tetractis tetractis (Ehrenberg, 1830)

Gemenc floodplain: RDU 02.05.2002., 25.09.2007.

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New and rare zerconid mites (Acari: Mesostigmata: Zerconidae) from the Crimean Peninsula, Ukraine

ZS. UJVÁRI[1]

Abstract: Elaborating a recent „Berlese" material collected from different habitats of the Crimean Peninsula (Ukraine) resulted in recording four zerconid mite species of which two, *Zercon bercziki* and *Zercon csuzdii* spp. nov. are new to science. On the basis of the newly identified material a more comlete description of *Z. karadaghiensis*, known only from Ukraine, is also given. With 50 figures.

INTRODUCTION

Most of the extensive faunistical and taxonomical studies on the mite family Zerconidae were made in Central Europe (e.g. Halašková, 1969; Błaszak, 1974; Mašán & Fenďa, 2004), however there are several areas – even countries – in this region of the continent, where this group has not been recorded at all. In Ukraine, studying of the zerconid mite fauna started only in the late 20th century. Balan described several new Zerconidae taxa from the Carpathians (Balan & Sergienko, 1990; Balan, 1991 a) to the steppe zone of the country (Balan, 1991 b, 1992 a, 1992 b), but our knowledge on the fauna of Ukraine is still scarce. The Crimean Peninsula is one of the moderately explored regions with three species recorded; *Zercon karadaghiensis* Balan, 1994, *Zercon ovalis* Balan, 1994 and *Zercon disparipila* Athias-Henriot, 1961 (Balan, 1995).

In the spring of 2009, one of my collegues (G. Szövényi) collected several soil samples from different habitats of the Crimean Peninsula. Elaborating this new material resulted in recording four zerconid mite species including two new to science. Apart from the new species, I also give a detailed description of a little-known species, *Z. karadaghiensis* Balan, 1992 described originally from Russian.

MATERIAL AND METHODS

Soil samples were taken from the forest floor of different forest types of the Crimean Peninsula. Mites extracted from the samples using Berlese-funnels were cleared with lactic acid and mounted in glycerine. Preparations were examined using a light microscope, drawings were made with the aid of drawing tube. The material stored in 70% ethanol and deposited in the Soil Zoology Collections of the Hungarian Natural History Museum. The terminology of setae follows Sellnick (1958), adopted by Błaszak (1974) and Mašán & Fenďa (2004). Measurements are given as mean, in micrometers. Abbreviations used: DN = deutonymphs.

Zercon bercziki sp. nov.

(Figs. 1–4)

Material examined. Holotype: female, Ukraine, Crimean Peninsula, Chatirdag Mts., south of Simferopol, near Mramorne village, N44 47' 09,4" E34 15' 38,6", 875 m a.s.l., beech forest (*Fagus orientalis*), from leaf-litter; leg. Szövényi, G., 19.05.2009. Paratypes: 13 ♀♀, 4 ♂♂ locality and date same that of the holotype. 2 ♀♀, 1 ♂ Ukraine, Crimean Peninsula, Chatirdag Mts., south of Simferopol, near Mramorne village, N44 48' 28,3" E34 14' 54,4", 615 m a.s.l., maple–oak mixed forest, from leaf-litter; leg. Szövényi, G. 19.05.2009.

Diagnosis. Anterior margin of ventroanal shield with two pairs of setae. Peritremes straight. Most of dorsal setae smooth, some of the marginal setae barely pilose. Opisthonotal I-, Z- and S-setae from short to long, growing in length

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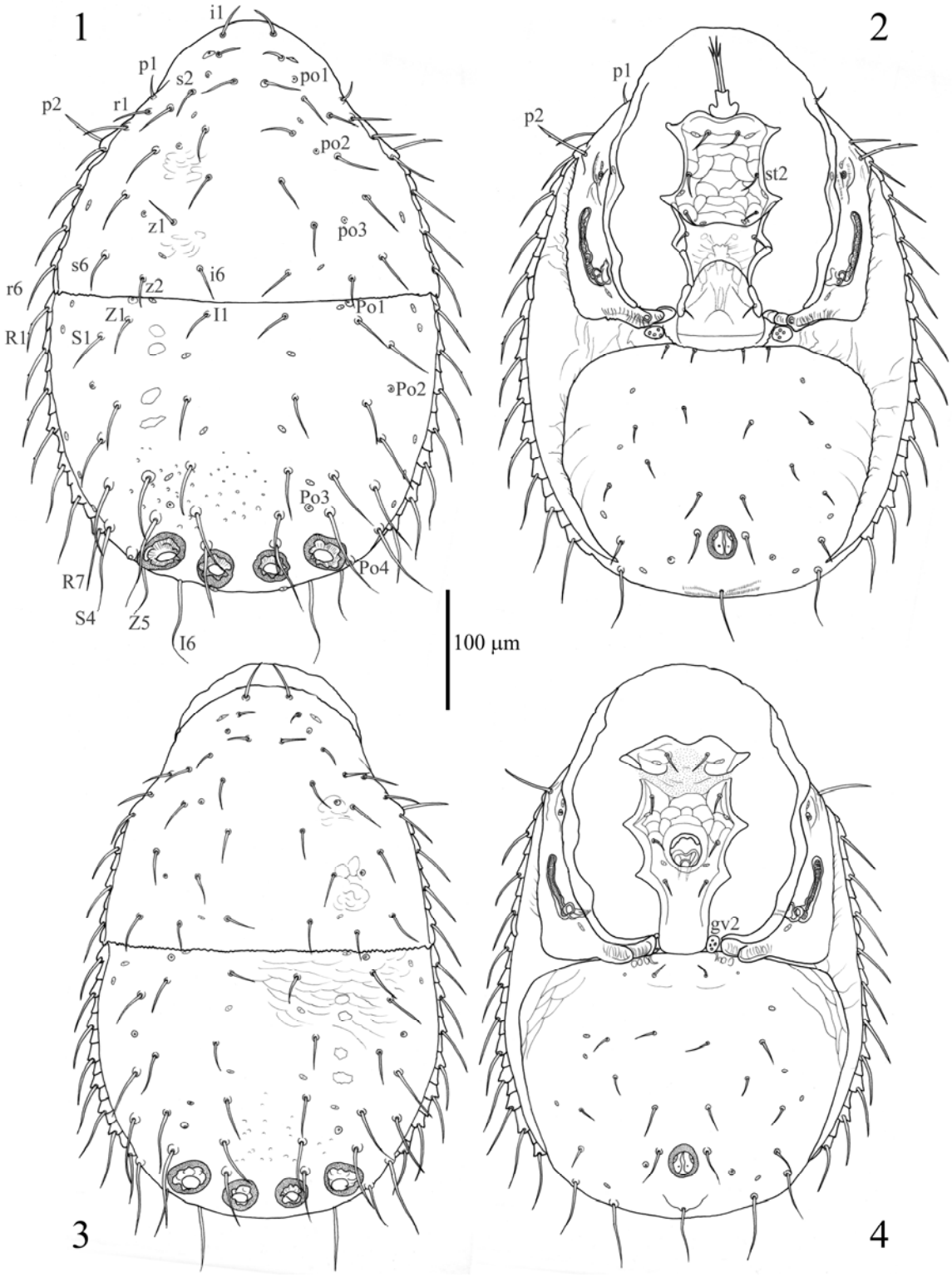


Figures 1–4. *Zercon bercziki* sp. n. 1 = dorsal view of female, 2 = ventral view of female, 3 = dorsal view of male, 4 = ventral view of male

posteriorly, setiform, tapering. Pores Po_2 situated on the line connecting S_1 and S_2, Po_3 above the line connecting I_4 and Z_4, near Z_4. Caudal surface of opisthonotum covered by small, depressed spots. Dorsal cavities strongly sclerotized, rotund, the inner pair slightly smaller than the outer pair. Marginal serration shallow, relatively acuminous.

Description. Female. Length of idiosoma: 476 μm; width: 328 μm (n = 16).

Dorsal side (Fig. 1). On podonotum, 21 pairs of different setae: i-row with six pairs, z-row with two pairs, s-row with five pairs, r-row with six pairs, p-row with two pairs. All podonotal setae smooth and setiform, even p_2 only scarcely pilose. Setae s_1 absent. Pores po_1 situated on the line connecting i_2 and s_2, po_2 on the line connecting i_4 and s_4, po_3 on the line connecting z_1 and s_5. Sculpturing pattern of podonotum weakly developed. Almost the whole surface of the shield smooth, only four small, irregularly elevated areas can be observed between setae i_5–s_4 and i_6–z_1. On opisthonotum, 22 pairs of different setae: I-row with six pairs, Z-row with five pairs, S-row with four pairs and R-row with seven (or eight) pairs. I-, Z- and S-setae setiform, smooth, apically tapering, growing in length posteriorly. Setae $I_{3–5}$, $Z_{3–4}$ and $S_{2–3}$ reaching beyond the insertion of the following setae, $I_{5–6}$, $Z_{4–5}$ and $S_{3–4}$ expanding beyond the margin of idiosoma. Setae S_2 situated beneath the line of setae Z_2, S_1 reaching approximately half the distance between insertions of $S_{1–2}$. The seven or eight pairs of marginal setae elongated, often bearing one pilus on their distal third. Pores Po_1 situated anteromedially to insertions of Z_1, Po_2 lying on the line connecting S_1 and S_2, Po_3 above the line connecting I_4 and Z_4, closer to Z_4, Po_4 sitting laterally to the insertions of Z_5. Marginal serration shallow, relatively acuminous. Anterior surface of opisthonotum smooth, only a couple of polygonal depressions can be found between I- and Z setal-rows. Caudal surface of latter shield covered by small, depressed spots. Dorsal cavities large, well sclerotized, their lateral tips fused posteriorly, forming a ring-like structure. These rosettes having smooth outer- and undulate inner margins, lying in a row, often reaching the caudal margin of idiosoma. The inner pair slightly smaller than the outer pair. The size of setae and the distances between their insertions according to Table 1.

Ventral side (Fig. 2). Peritremal shield considerably narrow, peritremes straight. Both peritremal setae smooth, however p_2 usually show very fine distal pilosity. Sternal shield well sclerotized, 96 μm long and 67 μm wide at the level of setae st_2. Four openings of glands gv_2 situated on conspicuous adgenital plates. Anterior margin of ventroanal shield with two pairs of setae. All sternal and ventroanal setae smooth, needle-like. Adanal pores gv_3 situated posterolaterally to adanal setae. Anal valves with vestigial euanal setae and a pair of anal lyrifissures. Ventroanal shield caudally fused to the opisthonotal shield. Sternal shield covered by reticulate pattern, surface of ventroanal shield without ornamentation.

Male (Figs 3–4). Length of idiosoma: 395 μm; width: 253 μm (n = 5). Chaetotaxy, poroidotaxy and sculpturing pattern of dorsal shields similar to that of the female. The body-shape much more elongated and narrow than in female, and some of the opisthonotal setae slightly shorter in proportion to the body size. Anterolateral surface of opisthonotum with weakly developed reticulate ornamentation. Sternogenital shield diveded by a weakly sclerotized slit behind the first pair of sternogenital setae st_1, bearing only four pairs of setae (setae st_5 absent). Anterior margin of ventroanal shield bears only one pair of setae, unlike in female. The size of opisthonotal setae and the distances between their insertions according to Table 1.

Immature stages. Unknown.

Etymology. The new species is dedicated in honor of Prof. Dr. Árpád Berczik (Budapest) on his 80th birthday.

Remarks. The new species resembles *Zercon cabylus* Athias-Henriot, 1961 and *Zercon navarrensis* Moraza, 1989 by the chaetotaxy of opisthonotal shield, by the absence of setae s_1. In case of

Z. navarrensis, it is also simylar by the sexual dimorphism in the number of setae on the anterior margin of ventroanal shield furthermore by the absence of sternogenital setae st_5 in male.

The three species can be distinguished by the following features: I-setae growing in lenght posteriorly (equally to Z- and S-setae) in *Z. bercziki*, in the other two species all I-setae are relatively short. Setae S_2 are situated much closer to S_3 than to S_1 in *Z. berczki*, unlike in the other two species where S_2 situated equidistantly to S_1 and S_3. Pores Po_2 are found on the line connecting S_2 and S_3 in Z. *bercziki*, however in the other two species it is situated on the line connecting Z_2 and S_2. Dorsal fossae are large, rotund, almost equal in size in *Z. bercziki*, saddle-like in *Z. navarrensis* and significantly differ in size in *Z. cabylus* (outer ones two times larger than inner ones). The opisthonotum is punctuated in *Z. bercziki* and *Z. cabylus*, but smooth in *Z. navarrensis.* The sternal shield is elongated in *Z. bercziki* but it is much shorter in proportion to the body length in the other two species.

Zercon csuzdii sp. nov.

(Figs. 5–10, 16–33)

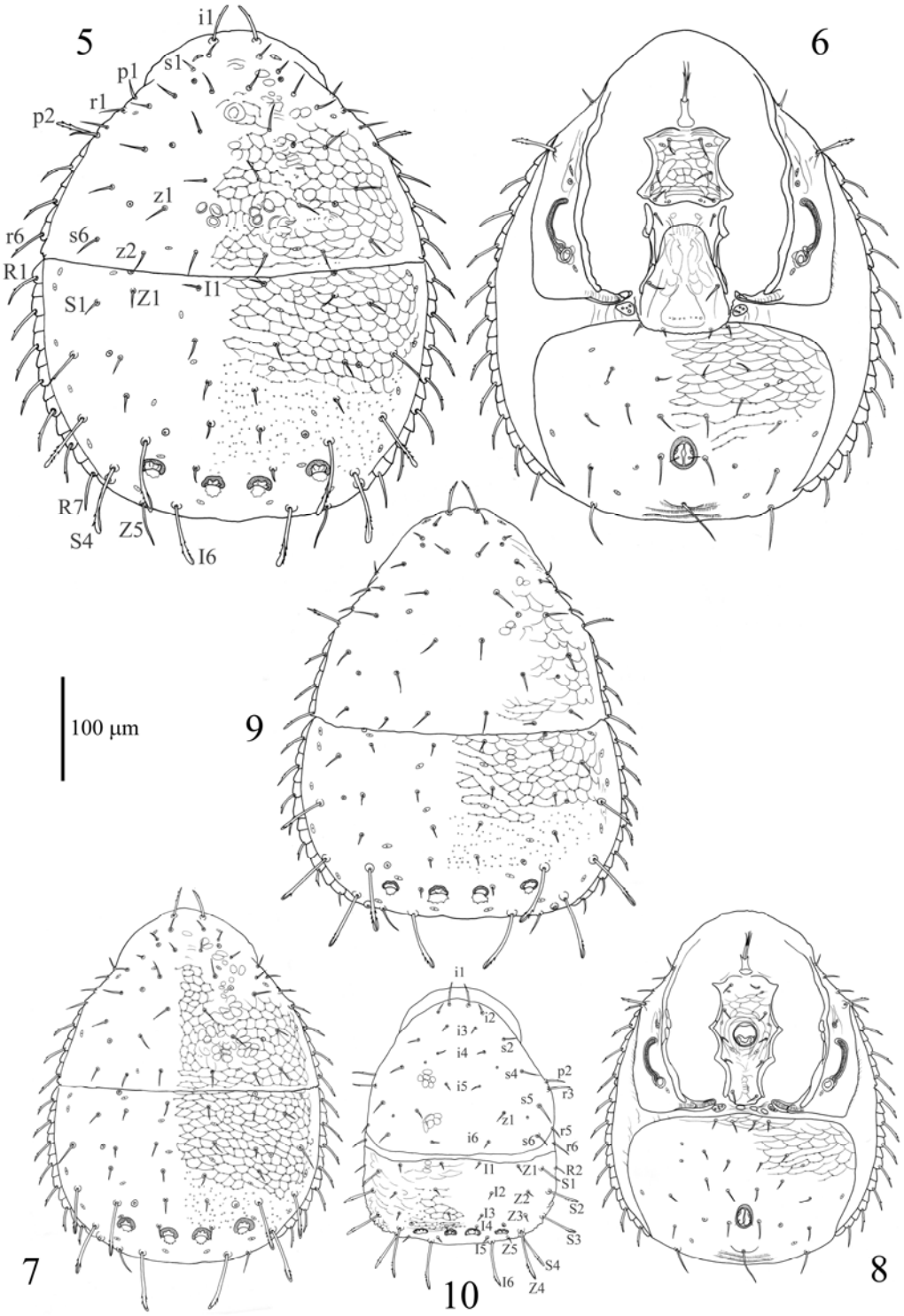
Material examined. Holotype: female, Ukraine, Crimean Peninsula, Chatirdag Mts., south of Simferopol, near Mramorne village, N44 47' 09,4" E34 15' 38,6", 875 m a.s.l., beech forest (*Fagus orientalis*), from leaf-litter. Leg. Szövényi, G., 19.05.2009. Paratypes 10 ♀♀, 8 ♂♂, 9 DN, 1 PN locality and date same as that of the holotype.

Diagnosis. Anterior margin of ventroanal shield with two pairs of setae. Peritremes arcuate. Marginal r- and R-setae finely pilose and flared distally. Setae I_6, Z_4 and $S_{3–4}$ long, thickened, with hyaline ending, other I-, Z-setae and S_1 short, smooth. Pores Po_3 lying on the line connecting I_4 and Z_4. Podonotum and anterior half of opisthonotum covered by tile-like and reticulate ornamentation, posterior half of opisthonotum punctuated. Dorsal fossae of general size and appearance. Marginal serration shallow and obtuse.

Description. Female. Length of idiosoma: 470 μm; width: 385 μm (n = 12).

Dorsal side (Fig. 5). On podonotum, 22 pairs of different setae: i-row with six pairs, z-row with two pairs, s-row with six pairs, r-row with six pairs, p-row with two pairs. Setae i_1 and some of the marginal setae thickened, very finely pilose on their distal part, other podonotal setae short, smooth and needle-like. Pores po_1 situated on the line connecting s_1 and s_2, po_2 below the line connecting i_4 and s_4, po_3 below the line connecting z_1 and s_5. Central surface of podonotum with reticulate pattern, ornamented by small depressions in the crossing points, lateral surface covered by tile-like pattern. In the area bordered by setae i_5, z_1 and z_6, three pairs of well sclerotized alveolar cavities and a pair of small hillocks can be observed. On opisthonotum, 22 pairs of different setae (Figs 16-33): I-row with six pairs, Z-row with five pairs, S-row with four pairs and R-row with seven pairs. Setae $I_{1–5}$, $Z_{1–3}$ and S_1 uniform, short and smooth. Setae S_2 two times longer than S_1, delicately barbed. Setae Z_5 approximately as long as S_2, smooth. The remaining I-, Z- and S-setae elongated, thickened, apically pilose, bearing hyaline tips and reaching beyond the margin of idiosoma. Marginal R-setae similarly to r-setae thickened, flared, delicately pilose distally. Pores Po_1 stiuated anteriorly to the insertions of Z_1, Po_2 approximately on the line connecting Z_2 and S_2, closer to Z_2, Po_3 on the line connecting I_4 and Z_4, near Z_4, Po_4 near the insertions of S_4, in posterior or posteromedial position to it. Marginal serration shallow and obutse. Anterior half of opisthonotum covered by tile-like pattern, and ornamented also by small spots in the overlapping points. Posterior half with small, spot-like depressions. Dorsal cavities of general size and appearance, saddle-like, with smooth anterior and undulate posterior margins. The size of setae and the distances between their insertions according to Table 2

Ventral side (Fig. 6). Peritremes arcuate, C-shaped. Chaeto- and poroidotaxy of ventral shields typical for the genus. Sternal shield well sclerotized, 72 μm long and 65 μm wide at the level of setae st_2. Four openings of glands gv_2



Figures 5–10. *Zercon csuzdii* sp. n. 5 = dorsal view of female, 6 = ventral view of female, 7 = dorsal view of male, 8 = ventral view of male, 9 = dorsal view of deutonymph, 10 = dorsal view of protonymph

situated on conspicuous adgenital plates. Anterior margin of ventroanal shield with two pairs of setae. All sternal and ventroanal setae smooth, needle-like. Adanal pores gv_3 situated posterolaterally to adanal setae. Anal valves with a pair of euanal setae and anal lyrifissures. Ventroanal shield caudally fused to the opisthonotal shield. Sternal shield covered by reticulate pattern, surface of ventroanal shield with tile-like ornamentation, caudally punctuated.

Male (Figs 7–8). Length of idiosoma: 340 μm; width: 260 μm (n = 8). Chaetotaxy, poroidotaxy and sculpturing pattern of dorsal shields similar to that of the female, however setae S_2 slightly shorter. The long, hyaline-sheeted setae longer in proportion to the body size than in female. Sternogenital shield with five pairs of smooth setae. Beyond the sternogenital shield a couple of postgenital sclerites can be observed. The size of opisthonotal setae and the distances between their insertions according to Table 2.

Deutonymph (Fig. 9). Length of idiosoma: 395 μm; width: 320 μm (n = 9). Chaetotaxy and poroidotaxy of dorsal shields quite similar to that of the adults, however setae S_2 reaching beyond the margin of idiosoma and having hyaline ending. The ornamentation of dorsal shields and dorsal cavities basically similar to that of the female, but less developed. The size of opisthonotal setae and the distances between their insertions according to Table 2.

Protonymph (Fig. 10). Length of idiosoma: 395 μm; width: 320 μm (n = 1). On podonotum, setae i_1, r_3 and p_2 elongated, apically barbed, others shorter, simple and smooth. Podonotal poroidotaxy similar to that of the adults, sculpturing pattern very weakly developed, can only be ide0tified between setae i_4–s_4 and i_6–z_1. Opisthonotal setae $I_{1–5}$, $Z_{1–3}$, Z_5 and R_2 similar in shape and length, short and smooth. Setae S_2 three times longer than the mentioned short setae, apically barbed, reaching beyond the margin of the shield. Other opisthonotal setae 5–7 times longer than the former short setae, apicaly serrated, bearing hyaline sheets and expanding beyond the margin of idiosoma. Opisthonotum anteriorly covered by weakly developed tile-like pattern, medially reticulated, bearing small, depressed spots in the crossing points, posteriorly the reticulation disappearing, the surface punctuated. Dorsal cavities weakly sclerotized, with undulate anterior and posterior margins. The size of opisthonotal setae and the distances between their insertions according to Table 2.

Larva. Unknown.

Etymology. The new species is dedicated in honor of the prominent earthworm specialist Dr. Csaba Csuzdi (Budapest).

Remarks. Balan (1995) redescribed the Iberian species *Zercon guadarramicus* var. *disparipila* Athias-Henriot, 1961 on the basis of a Crimean material and elevated the varietas to specific rank. According to the description and illustrations of Balan, the specimens described in the present paper are similar in every important characters to the ones recorded from the Crimean Peninsula in 1995. However, these are completely different from *Z. guadarramicus* var. *disparipila.* Therefore establishing a specific status of *Z. disparipila* is presumably based on a misidentification and Balan's specimens are most likely conspecific with *Zercon csuzdii* sp. n. The characters by which the mites collected from these two distant geographical regions can be distinguished are as follows: every podonotal setae pilose in *Z. guadarramicus* var. *disparipila*, only marginal r-setae and i1 pilose in the Crimean specimens; the elongated setae bearing hyaline sheet on their distal 35-50% in *Z. guadarramicus* var. *Disparipila*, but only a relatively small hyaline tip is found in the Crimean specimens; dorsal cavities large, strongly sclerotized and situated in a row in *Z. guadarramicus* var. *disparipila*, smaller, saddle-like, and the outer pair situated more anteriorly than the inner pair in the Crimean specimens. However the specific status of *Zercon disparipila* seems to be adequate, confirmed by the shape and size of dorsal cavities, shape of opisthonotal setae and opisthonotal ornamentation.

The new species resembles *Zercon adoxyphes* Błaszak, 1979, *Zercon caucasicus* Błaszak, 1979,

Zercon ignobilis Błaszak, 1979 and *Zercon separatus* Urhan, 2001 by the similar opisthonotal chaetotaxy (I_6, Z_4 and $S_{3–4}$ long, other setae shorter) and the shape and size of dorsal cavities. The five species can be distinguished by the charachters listed in Table 4.

Zercon karadaghiensis Balan, 1992

(Figs. 11–15, 34–50)

Zercon karadaghiensis Balan, 1992b: 49.

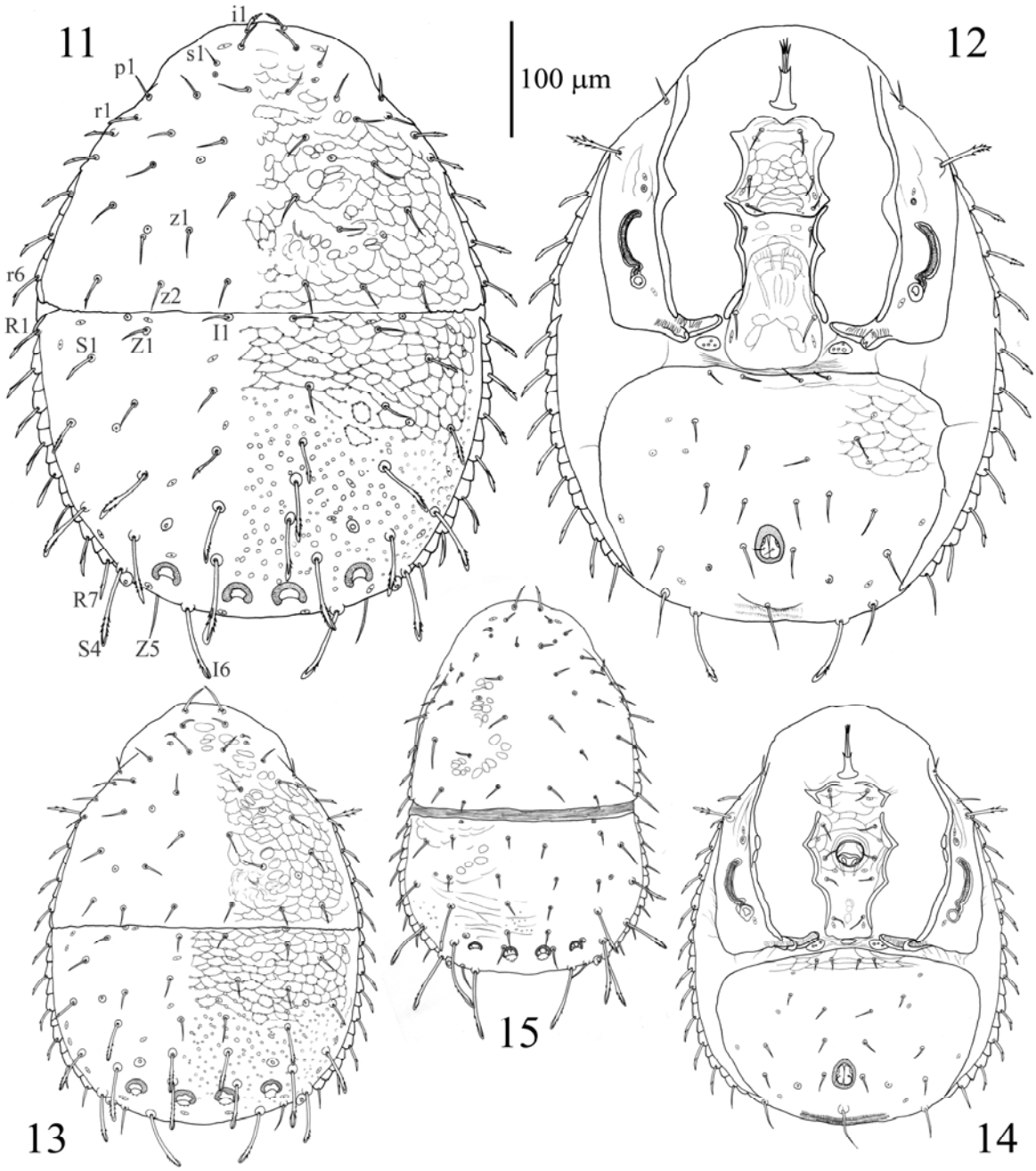
Material examined. Ukraine, Crimean Peninsula, Chatirdag Mts., south of Simferopol, near Mramorne village, N44 47' 09,4" E34 15' 38,6", 875 m a.s.l., beech forest (*Fagus orientalis*), from leaf-litter. Leg. Szövényi, G., 19.05.2009. (1 ♀ 2 ♂♂), Ukraine, Crimean Peninsula, Chatirdag Mts., south of Simferopol, near Mramorne village, N44 48' 28,3" E34 14' 54,4", 615 m a.s.l., maple mixed oak forest, from leaf-litter. leg. Szövényi, G., 19.05.2009. (1 ♀).

Diagnosis. Anterior margin of ventroanal shield with two pairs of setae. Peritremes arcuate. Marginal r- and R-setae slightly pilose and flared distally. Opisthonotal setae $I_{4–6}$, $Z_{3–4}$ and $S_{3–4}$ long, apically pilose, bearing hyaline sheet, I_3 and $S_{1–2}$ may also be barbed. Pores Po_3 situated on the line connecting I_4 and Z_4. Anterior surface of opisthonotum covered by tile-like pattern, posterior surface bearing large, depressed spots. Dorsal cavities of general size and appearance, with slightly undulate posterior margins. Marginal serration shallow and obtuse.

Description. Female. Length of idiosoma: 410 μm; width: 393 μm (n = 2).

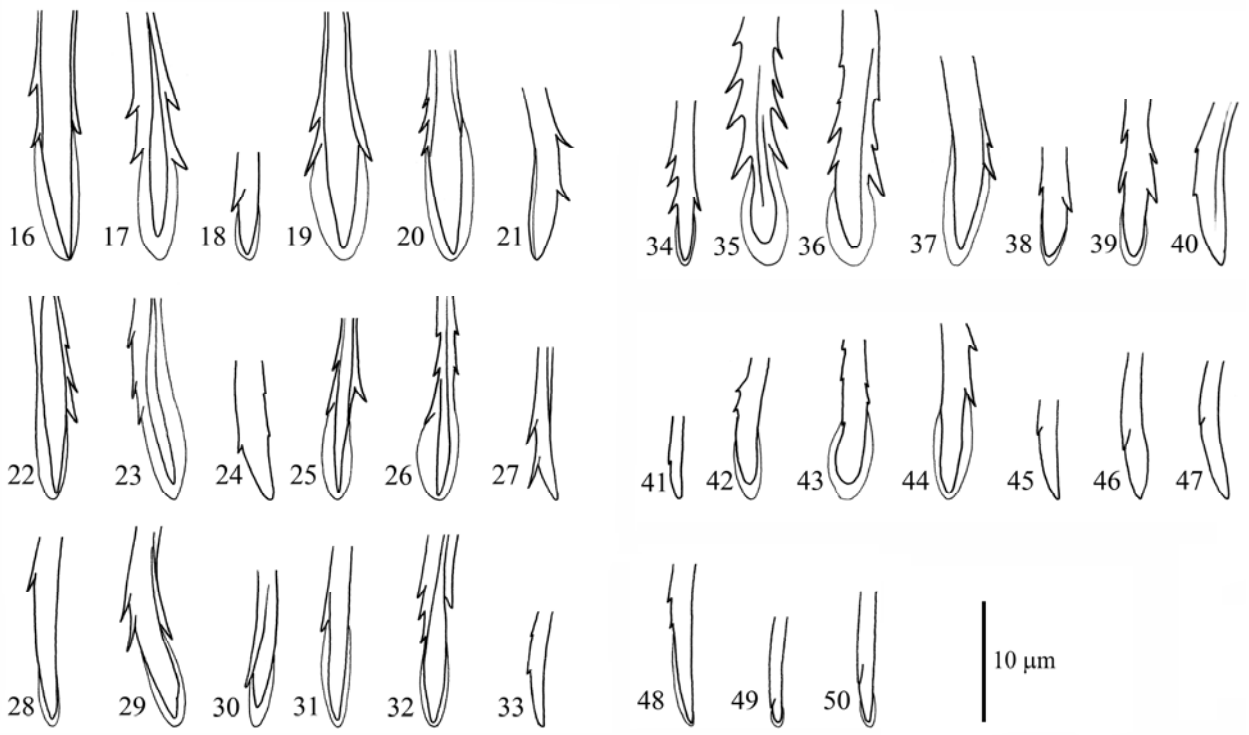
Dorsal side (Fig. 11). On podonotum, 22 pairs of different setae: i-row with six pairs, z-row with two pairs, s-row with six pairs, r-row with six pairs, p-row with two pairs. Setae i_1 densely, i_2 and s_6 delicately barbed, marginal r-setae scarcely pilose and flared distally. Other podonotal setae smooth and needle-like. Pores po_1 situated on (or inside) the line connecting s_1 and s_2, po_2 on the line connecting i_4 and s_4, po_3 below the line connecting z_1 and s_5. The central surface of podonotum covered by irregular pattern, between setae z_1 two hillocks with some strongly sclerotized structures can be observed, lateral surface of the shield with tile-like ornamentation. On opisthonotum, 22 pairs of different setae (Figs 34-50): I-row with six pairs, Z-row with five pairs, S-row with four pairs and R-row with seven pairs. Setae $I_{1–2}$ and $Z_{1–2}$ uniform, short and smooth, Z_5 also smooth, but longer than the above mentioned ones. Setae I_3 slightly longer than the previous members of the longitudinal row, $S_{1–2}$ similar in shape and length, distally pilose, with very fine hyaline tips. S_2 not reaching the margin of idiosoma. Setae $I_{4–6}$, $Z_{3–4}$ and $S_{3–4}$ long, distally barbed, apically broadening, with large hyaline endings, I_4 reaching the insertions of I_5, the tips of I_5 expanding beyond the margin of opisthonotum. Pores Po_1 situated anterolaterally to Z_1, Po_2 lying slightly below the line connecting Z_2 and S_2, Po_3 on the line connecting I_4 and Z_4, approximately equidistantly, Po_4 posteromedially to the insertions of S_4. Marginal serration shallow and obtuse. Anterior surface of opisthonotum covered by tile-like pattern, and ornamented also by small spots in the overlapping points. Posterior surface with large, spot-like depressions. Dorsal cavities of general size and appearance, saddle-like, with smooth anterior and undulate posterior margins. The size of setae and the distances between their insertions according to Table 3.

Ventral side (Fig.12). Peritremes arcuate, C-shaped. Chaeto- and poroidotaxy of ventral shields typical for the genus. Sternal shield well sclerotized, 68 μm long and 54 μm wide at the level of setae st_2. Four openings of glands gv_2 situated on conspicuous adgenital plates. Anterior margin of ventroanal shield with two pairs of setae. All sternal and ventroanal setae smooth, needle-like. Adanal pores gv_3 situated posterolaterally to adanal setae. Anal valves with a pair of euanal setae and anal lyrifissures. Ventroanal shield caudally fused to the opisthonotal shield Sternal shield covered by reticulate pattern, surface of ventroanal shield with tile-like ornamentation and with small depression in the overlapping points.



Figures 11–15. *Zercon karadaghiensis*. 11 = dorsal view of female, 12 = ventral view of female, 13 = dorsal view of male, 14 = ventral view of male, 15 = dorsal view of deutonymph

Male (Figs 13–14). Length of idiosoma: 360 µm; width: 273 µm (n = 2). Chaetotaxy, poroidotaxy and sculpturing pattern of dorsal shields similar to that of the female, except setae I_3 which without any apical structures in male. Smooth, simple, and elongated setae of opisthonotum longer in proportion to the body length than in female. Sternogenital shield diveded by a weakly sclerotized slit behind the level of setae st_1, bearing five pairs of setae. The size of opisthonotal setae and the distances between their insertions according to Table 3.



Figures 16–50. Tips of some opisthonotal setae of *Z. csuzdii* sp. n. female (16-21), male (22-27), deutonymph (28-33) and *Z. karadaghiensis* female (34-40), male (41-47) and deutonymph (48-50).
16 = I_6, *17* = Z_4, *18* = S_2, *19* = S_3, *20* = S_4, *21* = R_6, *22* = I_6, *23* = Z_4, *24* = S_2, *25* = S_3, *26* = S_4, *27* = R_6, *28* = I_6, *29* = Z_4, *30* = S_2, *31* = S_3, *32* = S_4, *33* = R_6, *34* = I_3, *35* = I_4, *36* = I_5, *37* = I_6, *38* = S_1, *39* = S_2, *40* = R_5, *41* = I_3, *42* = I_4, *43* = I_5, *44* = I_6, *45* = S_1, *46* = S_2, *47* = R_5, *48* = I_6, *49* = S_1, *50* = S2

Deutonypmh (Fig. 15). Length of idiosoma: 320 µm; width: 200 µm (n = 2). Chaetotaxy and poroidotaxy of podonotum similar to that of the adults. On opisthonotum, setae $I_{1–5}$ short and smooth, without apical pilosity or hyaline sheets, slightly growing in length posteriorly. Setae $Z_{1–2}$, Z_5 and S_3 similar in shape to mentioned I-setae, Z_5 and S_1 approximately twice as long as $Z_{1–2}$. S_2 1.5 times longer than S_1, apically barbed, with small hyaline tips, expanding beyond the margin of idiosoma. Setae I_6, $Z_{3–4}$ and $S_{3–4}$ markedly elongated, reaching beyond the margin of the shield. Poroidotaxy of opisthonotum similar to that of the adults, sculpturing pattern weakly developed, anterior surface covered by a recognizable tile-like structure, posterior regions ornamented by small, depressed spots and an irregular reticulation of fissures. Dorsal cavities smaller and less sclerotized than in mature stage. The size of opisthonotal setae and the distances between their insertions according to Table 3.

Remarks. The female specimens found in the Crimean Peninsula differ in some characters from the others described by Balan in 1992. In the case of the newly found specimens setae S_1 are delicately pilose on their apical part, S_2 do not reach the margin of idiosoma and the posterior margin of dorsal cavities is barely undulate. Even so, the specimens studied here are conspecific with those of Balan (1992), these slight differences may come from the different preparation method and intraspecific variability. The ventral characters are not adequately described in the original description, hence it is not possible to make a particular comparison. The redescription of the species was neccessary because of this deficiency and furthermore the language of the original de-

scription adoptable only for a specific group of acarologists.

Distribution. Ukraine.

Zercon foveolatus Halašková, 1969

Zercon foveolatus Halašková, 1969: 252., Petrova 1977: 604., Karg 1993: 315., Mašán & Fenďa 2004: 120., Ujvári & Kontschán 2007: 109.

Material examined. Ukraine, Crimean Peninsula, Chatirdag Mts., south of Simferopol, near Mramorne village, N44 48' 28,3" E34 14' 54,4", 615 m a.s.l., maple mixed oak forest, from leaf-litter. Leg. Szövényi, G, 19.05.2009 (4 ♀♀).

Distribution. Slovakia, Ukraine, Romania and Hungary.

Acknowledgements – The collection trip was supported by the LIFE Plus program, title: „Conservation of Hungarian meadow viper (*Vipera ursinii rakosiensis*) in the Carpathian-basin". I would like to express my sincere gratitude to Dr. Peter Mašán for the helpful comments during the preparation of the manuscript.

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Table 1. Lengths of opisthonotal setae and distances between setal bases within longitudinal rows in *Zercon bercziki* sp. n.

	♀	♂		♀	♂		♀	♂
I1	28	20	**Z1**	33	26	**S1**	37	29
I1-I2	71	50	**Z1-Z2**	70	58	**S1-S2**	82	56
I2	35	23	**Z2**	37	28	**S2**	47	40
I2-I3	58	44	**Z2-Z3**	66	44	**S2-S3**	41	34
I3	42	31	**Z3**	53	45	**S3**	59	48
I3-I4	39	32	**Z3-Z4**	34	28	**S3-S4**	35	33
I4	52	38	**Z4**	78	52	**S4**	70	57
I4-I5	27	23	**Z4-Z5**	44	29			
I5	60	39	**Z5**	44	35			
I5-I6	37	31						
I6	71	52						

Table 2. Lengths of opisthonotal setae and distances between setal bases within longitudinal rows in *Zercon csuzdii* sp. n.

	♀	♂	**DN**	**PN**		♀	♂	**DN**	**PN**		♀	♂	**DN**	**PN**
I1	16	13	10	7	**Z1**	16	9	10	7	**S1**	17	12	14	22
I1-I2	54	37	46	28	**Z1-Z2**	64	36	45	26	**S1-S2**	55	36	45	21
I2	19	13	10	7	**Z2**	18	9	11	7	**S2**	39	24	41	31
I2-I3	45	30	36	25	**Z2-Z3**	36	21	37	21	**S2-S3**	62	43	54	25
I3	17	11	9	7	**Z3**	17	11	10	7	**S3**	59	43	58	36
I3-I4	39	26	31	12	**Z3-Z4**	44	31	34	15	**S3-S4**	58	40	46	26
I4	15	12	9	5	**Z4**	70	50	58	48	**S4**	66	50	57	37
I4-I5	43	26	31	14	**Z4-Z5**	60	47	42	12					
I5	13	12	9	6	**Z5**	42	23	24	8					
I5-I6	40	30	28	7										
I6	58	54	56	44										

Table 3. Lengths of opisthonotal setae and distances between setal bases within longitudinal rows in *Zercon karadaghiensis*.

	♀	♂	**DN**		♀	♂	**DN**		♀	♂	**DN**
I1	22	13	10	**Z1**	23	13	10	**S1**	28	14	20
I1-I2	61	38	32	**Z1-Z2**	65	44	38	**S1-S2**	59	40	35
I2	24	16	10	**Z2**	23	16	11	**S2**	31	23	29
I2-I3	50	35	25	**Z2-Z3**	56	30	25	**S2-S3**	74	43	36
I3	34	20	12	**Z3**	54	32	40	**S3**	56	37	42
I3-I4	58	30	22	**Z3-Z4**	57	38	29	**S3-S4**	59	39	33
I4	50	34	14	**Z4**	55	46	56	**S4**	65	42	49
I4-I5	43	27	15	**Z4-Z5**	53	32	22				
I5	69	39	16	**Z5**	43	23	20				
I5-I6	48	32	27								
I6	64	48	57								

Table 4. Distinguishing characters between *Z. csuzdii* sp. n., *Z. adoxyphes*, *Z caucasicus*, *Z. ignobilis* and *Z. separatus*

Characters	***Z. csuzdii***	***Z. adoxyphes***	***Z. caucasicus***	***Z. ignobilis***	***Z. separatus***
Number of setae on anterior margin of ventroanal shield	two pairs	one pair	one pair	one pair	one pair
Setae S_2	apically barbed, two times longer than S_1	smooth, as long as S_1	smooth, as long as S_1	smooth, as long as S_1	smooth, as long as S_1
Long opisthonotal setae	with hyaline sheets	without hyaline tips	without hyaline tips	without hyaline tips	with hyaline sheets
Caudal surface of opisthonotum	punctuated	smooth	smooth	punctuated	punctuated
Marginal setae	longer, pilose	longer, pilose	longer, pilose	short, smooth	longer, pilose
Pores Po_3	on the line connecting I_4 and Z_4	on the line connecting I_4 and Z_4	on the line connecting I_3 and Z_4	on the line connecting I_5 and Z_4	on the line connecting I_4 and Z_4

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Long-term changes of sterlet (*Acipenser ruthenus*) population in the Hungarian section of the Danube

G. GUTI[1] and T. GAEBELE[1]

Abstract. Sturgeons had played an important role in the history of Hungarian fisheries, but due to over-fishing, followed by extensive river regulations and deterioration of habitats, there has been a considerable decrease in populations which are now on the verge of extinction. Sterlet (*Acipenser ruthenus*) is only a common species caught for commercial and recreational purposes. The main factors of sterlet population dynamics were evaluated according to the new international efforts for sturgeon conservation. A moderate correlation was confirmed between the annual sterlet catches and the fluctuation of the hydrological regime of the Danube. Assessment of restocking activity and population recruitment demonstrated low efficiency of remedial measures for the Danubian sterlet.

INTRODUCTION

A number of historical records prove the importance of sturgeon fisheries along the Middle Danube from the Palaeolithic Age. Remains of large sturgeons were recovered from archaeological sites in the Iron Gate Gorge and in the Little Hungarian Plane (Bartosiewitz, 1997). These records indicate the role of the sturgeons in prehistoric nutrition 7000–9000 years ago and in the Roman Ages (1st to 4th century). In the Middle Ages, between the 11th and 16th centuries sturgeon fishery flourished along the Middle Danube, however, the regulation of sturgeon fishery became powerless during the 16th century, and most of the fish migrating to spawn for the first time were caught. The fishing mortality surpassed the recruitment of populations and this over-exploitation caused a decreasing trend in catches in the following centuries and the large sturgeon species became an occasional capture along the Middle Danube in the 19th century (Kriesch, 1876; Károli, 1877; Herman, 1887; Khin, 1957; Hensel & Holčik, 1997; Guti, 1998, 2006, 2008). Remnants of anadromous sturgeon populations have collapsed due to the blocking of their spawning migratory way since the construction of 'Iron Gate I' (1970) and 'Iron Gate II' (1984) hydroelectric dams. Nowadays great sturgeon (*Huso huso*) and stellate sturgeon (*Acipenser stellatus*) are practically eliminated from the Middle Danube and small stocks of ship sturgeon (*A. nudiventris*) as well as the resident form of Russian sturgeon (*A. gueldenstaedti*) occur sporadically. Sterlet (*A. ruthenus*) is the only common species caught for commercial and recreational purposes (Bacalbasa-Dobrovici, 1989, 1997; Hensel & Holčik, 1997; Reinartz, 2002; Guti, 2008).

The sterlet was formerly very abundant and regularly occurred from Regensburg to the Danube Delta. It inhabited most of the major tributaries of the Middle Danube: the Rivers Morava, Váh, Hron, Ipel, Rába, Dráva, Sava, Tisza, Szamos, Bodrog, Zagyva, Körös, Maros (Heckel & Kner, 1858; Herman, 1887; Sokolov & Vasil'ev, 1989; Hensel & Holčik, 1997; Reinartz, 2002). Nowadays, sterlet is the most widely distributed sturgeon in the Danube; however, it has been almost extirpated in the German and Austrian section of the river, where its occurrence depends on stocking (Zauner, 1997; Reinartz, 2002), and it has a limited distribution in the basin of the Middle and the Lower Danube (Hensel & Holčik, 1997; Reinartz, 2002). It is an endangered species according to the IUCN Red List (Kottelat & Freyhof, 2007), but it plays a remarkable role in the fisheries in the Hungarian section of the Danube. The catches were unbalanced in the last half century and the main factors determining changes in sterlet population were analyzed in relation to the international efforts for the conservation of the Danubian sturgeons (Bloesch *et al.,* 2005, 2006).

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METHODS

Changes of sterlet population was described by published catch statistics and personal interviews with fishermen. Data relating to long-term sterlet catch of the Hungarian fishermen were published (Jaczó, 1974; Tóth, 1979; Jancsó & Tóth, 1987) and Serbian catch statistics were obtained from the Serbian Statistic Institute. The Hungarian Angler Association provided further information on recreational catches. Cross-correlations were used to analyse retarded effects of water level fluctuations on annual yields of sterlet. Series of monthly water level data were gathered from the internet (www.datanet.hu/hydroinfo). The statistical analyses were performed using the PAST software package (Hammer *et al*., 2001).

Change in biomass of a year-class in the population can be estimated by data of growth and survival (Ricker, 1975). Growth data of sterlet were obtained from the Hungarian-Slovak section of the Danube (Kovrižnych, 1988). The mean of annual survival rate was calculated by age distribution data surveyed in the Serbian section of the Danube (Janković, 1958).

RESULTS

In the second half of the 20th century, annual catches of commercial fishery varied from 0.5 ton in 1956 to 12.7 tons in 1995 and averaged 3.2 tons in the Hungarian section of the Danube. The catches indicated a decline in the 1950s and 1960s and started to increase in the 1970s and were relatively high till the end of the 1990s. Since the beginning of the 21st century, the annual catch is below the average.

Data of commercial fishery indicated a notable inconstancy in longitudinal distribution of sterlet (Fig. 1). Well-known sterlet fishing sites are at Győr and Paks in the Danube, where catch is related to spawning habitats and traditions of commercial fishery (Pintér, 2002). In the 1950s and 1960s 78% of catch was originated from the lower part of the Hungarian section of the Danube (downstream of Paks, r.km 1560–1433) and 11–11% was caught in the upper (upstream of Esztergom, r.km 1850–1709) and middle (between Esztergom and Paks, r.km 1709–1560) parts, while in the 1970s when catches improved, 62% of sterlet was fished in the middle stretch and 33% and 5% in the lower and upper stretches, respectively (Tóth, 1979).

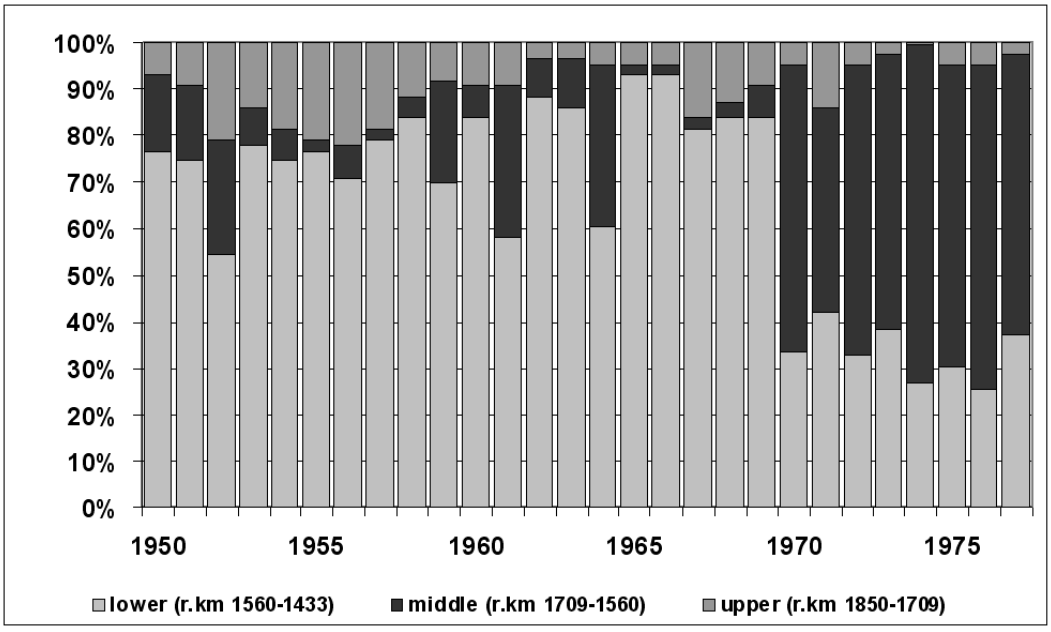

Figure 1. Relative catches of sterlet in three parts of the Danube in Hungary between 1950 and 1977

According to several fishery managers, artificial recruitments contributed to the improvement of sterlet catches from the 1970s. Regular restocking of sterlet started in the second half of the 1970s, when its artificial propagation was developed in Hungary. Individuals of young sterlet fry of 3–10cm were released in the Danube and Tisza in the 1980s; however, this restocking activity was not systematic and its documentation is incomplete. Estimated quantity of restocked juveniles varied between 10,000 and 100,000 specimens annually. Sterlet fry stocking has become occasional recently: 80,000 individuals in 1988; 3,000 in 1991; 5,000 in 1992, 20,000–20,000 in 1996, 1999 and 2000, and 60,000 in 2002 were released in the Hungarian section of the Danube.

The mean of annual survival rates (S = 0.54) was estimated by age distribution of 1246 specimens (age: from 3+ to 13+) collected in the Serbian section of the Danube (Janković 1958). In the event of the stocking of 0+ juvenile by 10,000 individuals (length 10cm, weight 8.7g), the expected biomass of the age group could weigh about 150kg when they reach the spawning maturity (5+) (Fig. 2). At the 5+ age the mean length of the individuals is close to the minimum size at which sterlet could be legally caught.

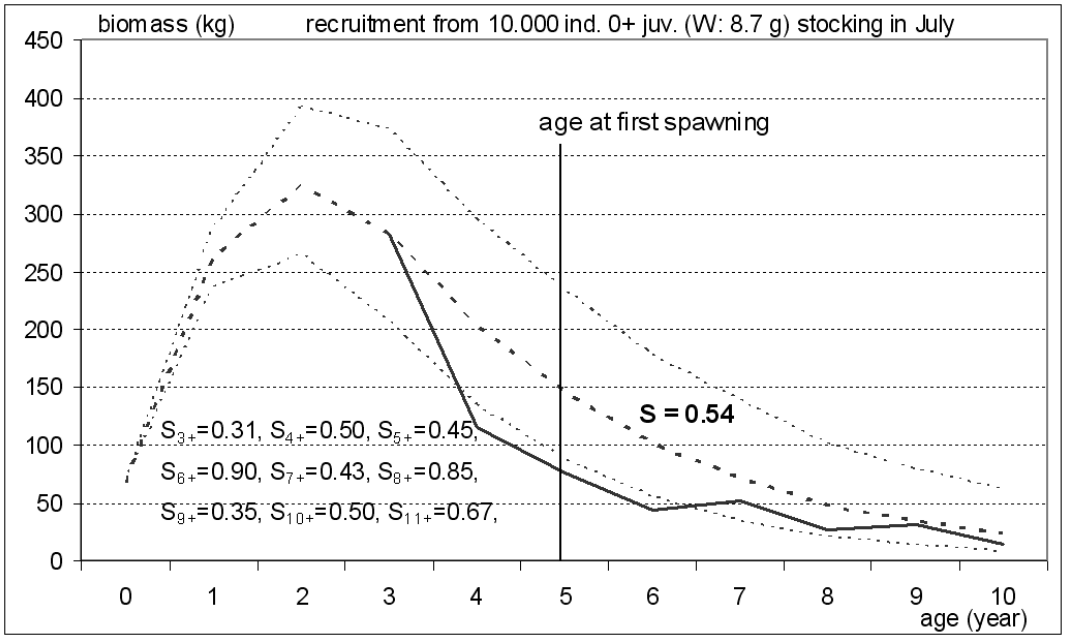

Figure 2. Course of change in biomass of a hypothetical year-class in sterlet population from 10,000 individuals of recruits at 0+ age in the Middle Danube (thick broken curve) according to an estimated mean survival rate (S). Thin broken curves mark standard error. Solid curve indicates the variation in biomass according to the calculated annual survival rates (S_{3+} - S_{11+}) (computation from data of Janković, 1958 and Kovrižnych, 1988)

Changes of sterlet population dynamics are presumably conditioned by the long-term fluctuation of the hydrological regime of the Danube (Fig. 3). Cross-correlation functions detected retarded effects of water level fluctuations on annual catch of sterlet between 1950 and 1977 in the Hungarian section of the Danube. Moderate significant negative correlation was recognized between the annual catch and water levels recorded 1–4 or 5 years earlier from March to June and September. In contrast, positive correlation was established between the annual catch and average monthly water levels recorded 10–12 years earlier in May (Fig. 4).

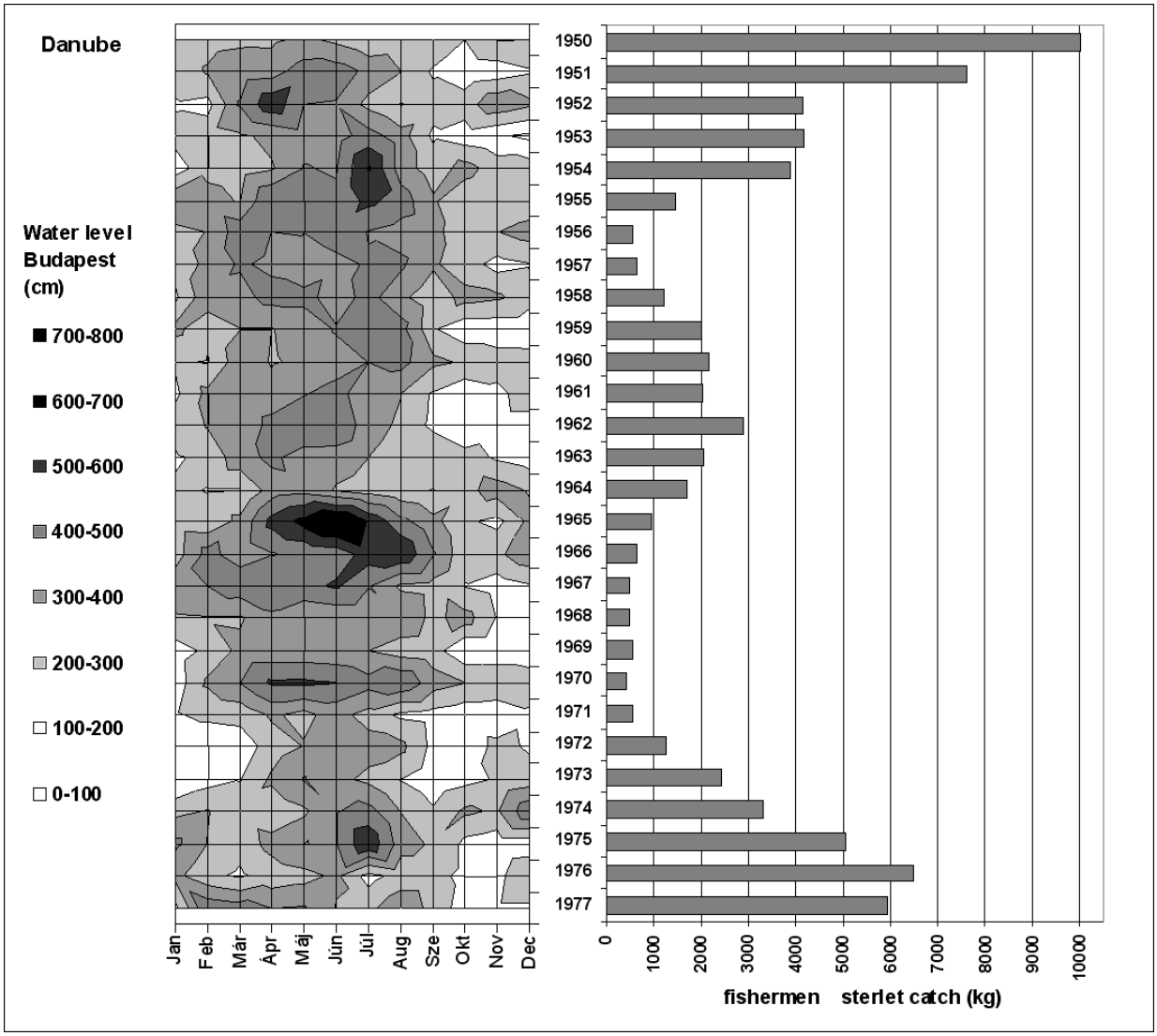

Figure 3. Changes of the average monthly water levels at Budapest and sterlet catches of commercial fishermen in the Hungarian section of the Danube between 1950 and 1977

The influence of hydrological regime on sterlet population is demonstrable by the correlation betwen water levels and catches. Considerable negative correlation ($R^2 = 0.90$) was established between the 5 year average of monthly low water levels and 5 year average of sterlet catches in the upper part of the Hungarian section of the Danube (r.km 1850–1768) in a forty-year period, between 1950 and 1990 (Fig. 5).

Temporal changes of sterlet catches can be related to habitat alterations. In the Danube stretch between r.km 1850–1768 sterlet catches began to improve in the 1980s (Fig. 6), when the mean annual catch increased from 0.15 tons to 2.0 tons (Jancsó & Tóth, 1987). However, catches declined sharply due to alteration of local spawning sites of sterlet after construction of the Gabčikovo hydropower station and annual catches of fishermen have been fewer than 10 specimens since 1992 (Guti, 2008).

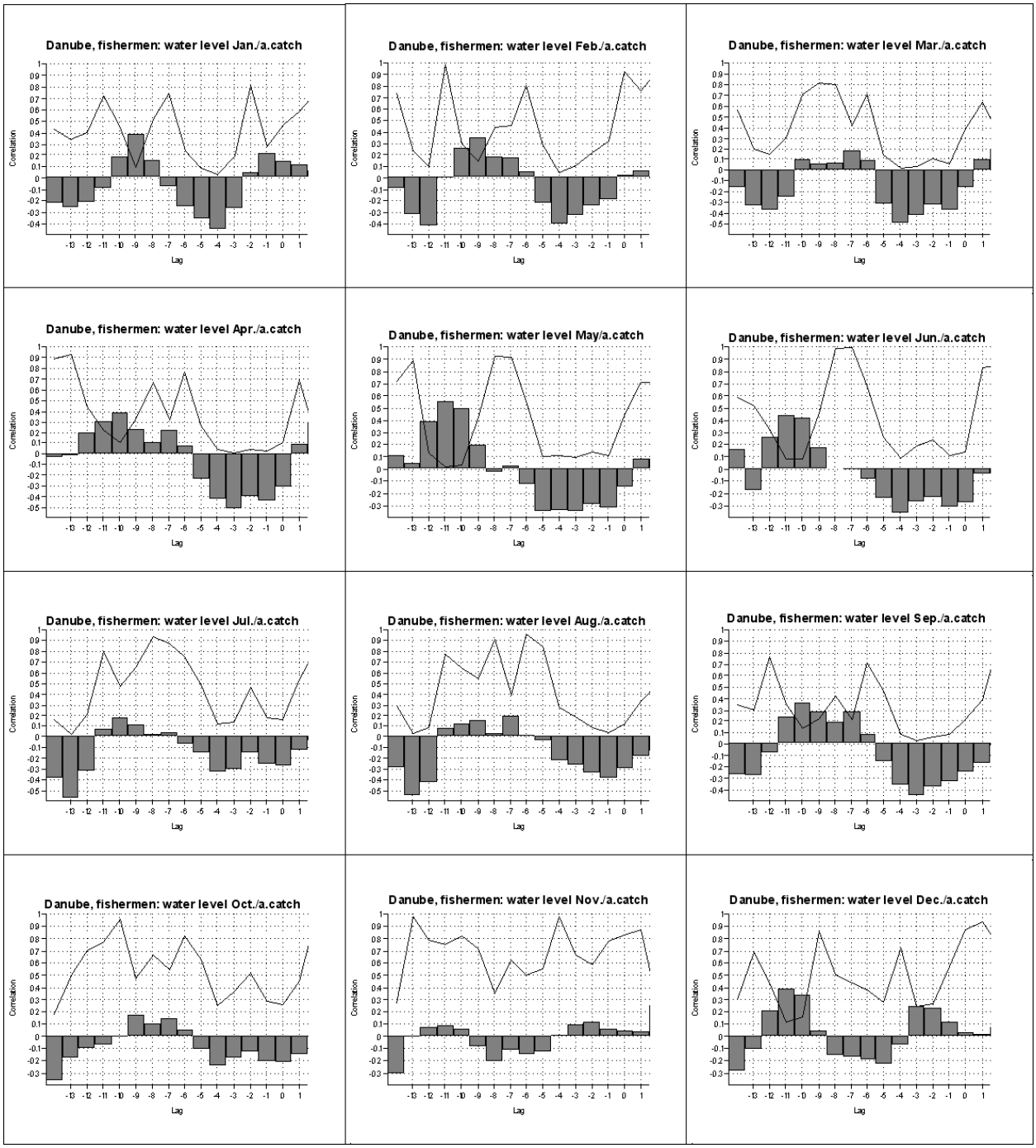

Figure 4. Cross-correlation between the average monthly water levels at Budapest and the annual sterlet catches of commercial fishermen in the Hungarian section of the Danube. The line marks the positive range of the confidence limit. The negative range is its mirror image. Lag number correspond to years

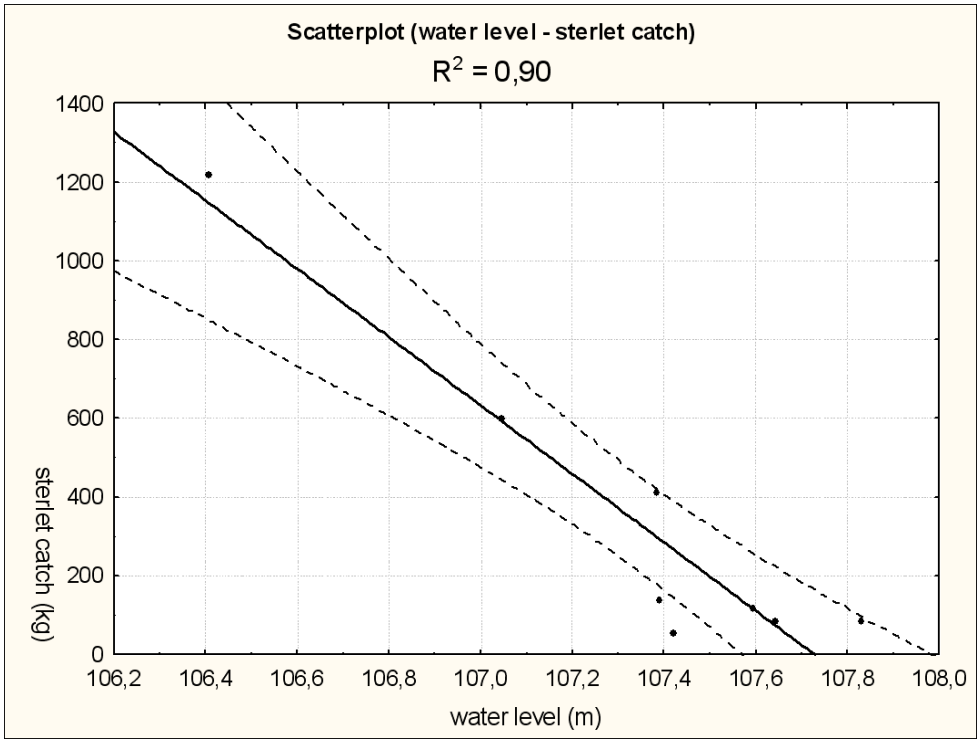

Figure 5. Correlation between the 5 year average of monthly low water levels at Gönyü and 5 year average of sterlet catches in the upper part of the Hungarian section of the Danube (r.km 1850–1768) between 1950 and 1990

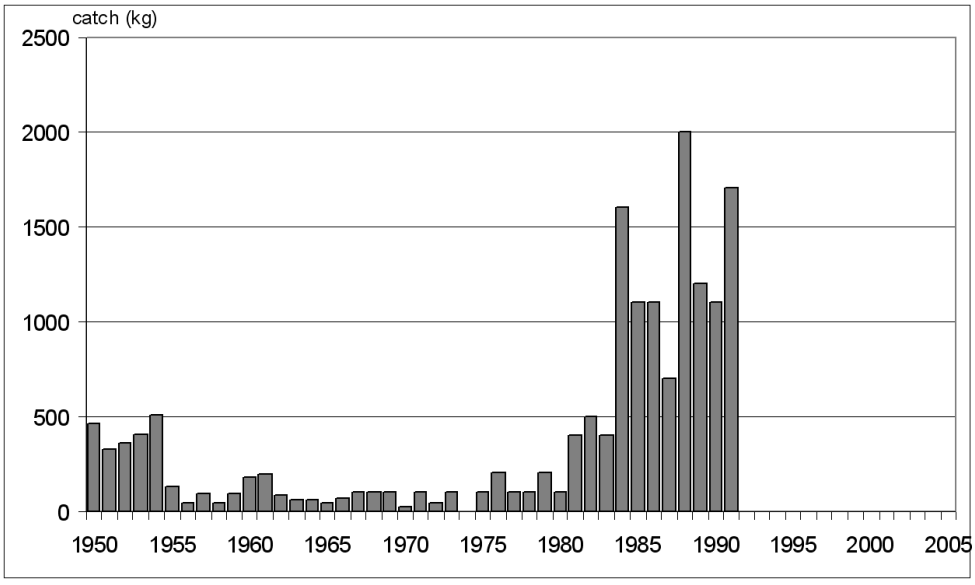

Figure 6. Sterlet catches of commercial fishery (data of the fishery cooperative of Győr) in the upper part of the Hungarian section of the Danube (r.km 1850–1768) between 1950 and 2005

DISCUSSION

The catch statistics indicate an unbalanced sterlet population in the Hungarian section of the Danube in the second half of the 20th century. The stock was partially recovered from the 1970s to the 1990s (Fig. 3, Fig. 6). According to several authors (Tóth, 1979; Pintér, 1991; Hensel & Holčik, 1997) the population increases in the 1970s were presumably due to emigration of individuals from the impoundment of the Iron Gate I dam, as well as the improving water quality and stocking of juveniles. In the fishing area of Smederevo in the former Yugoslavia (upstream of the Iron Gate I dam and downstream of the Sava tributary) a rapid and considerable increase (more than 6-fold) was observed in sterlet catches in 1973–1974 after the construction of the Iron Gate I dam; however, in the fishing area of Vojvodina (upstream of the Sava tributary) catch increased less (43%) in the same period but raised gradually in the second half of the 1970s. Sterlet catch had a similar trend in Hungary and there is a good correlation ($r = 0.82$) between the catches of the Hungarian and the Vojvodina sections of the Danube from 1969 to 1977. Therefore, catch statistics verify only a restricted upstream movement of sterlet from the Iron Gate dam to the upper part of its impoundment and do not confirm the presumption of sterlet migration to the Hungarian section of the Danube.

According to the general view of Hungarian fishermen, restocking program contributed to the improvement of sterlet catches. The quantity of restocked juveniles varied between 10,000 and 100,000 individuals from the second half of the 1970s to the end of the 1980s. The posterior output of this activity was about 150–1,500kg annual additions to the total biomass of the adult sterlet population (Fig. 2) in the 1980s and 1990s, but then again catches started to rise in the first half of the 1970s, before the beginning of the regular restocking program and the increase was more than 5,000kg between 1971 and 1976, that is significantly higher than the calculated artificial recruitment.

Remarkable fluctuation in sterlet catches (Fig. 3) may be related to temporal changes of essential habitats. Cross-correlation analysis indicates the retarded effects of the water levels on sterlet catches (Fig. 4). In river ecosystems, floods and droughts are primary sources of disturbance and restricted availability of spawning and nursery habitats may significantly impact on population recruitment and juvenile fish (Répássy, 1914; Kushlan, 1976; Poff & Allan, 1995; Wolter & Menzel, 2005). The significant correlation between the annual catch and the water levels recorded 1–5 years earlier during the spawning period leads to the conclusion that sterlet reproduction is more successful during low water level periods than floods. This supposition is confirmed by the high negative correlation ($R^2 = 0.90$) between the 5 year average of monthly low water levels and 5 year average of sterlet catches.

There are two kinds of sterlet spawning sites: the river bed and the fast flowing sites in the floodplain flooded by rising water. Spawning on the river bed occurs at a depth from 6 to 10m between April and May. The eggs are laid on mud-free pebbles 1 to 7cm in diameter, and rarely on gravel and sand bottoms. The current velocity at the spawning site ranges from 1.5 to 2.5m s^{-1} (Janković, 1958; Sokolov & Vasil'ev, 1989; Pintér, 2002). During a flood the increasing shear stress may destroy the eggs or juvenile specimens at the spawning and nursery sites.

Catches in the Szigetköz section of the Danube (Fig. 6) demonstrate the detrimental effect of sedimentation on sterlet reproduction. Nearly 80% of the discharge of the Danube has been diverted to the bypass canal of the Gabčikovo hydroelectric dam (r.km 1821) since 1992 (Guti, 1993, 2002). The extensive regulation altered the water flow and severely modified the sediment transport in the tributary of the Bagoméri sidearm (r.km 1810), which is the single spawning site of sterlet in the Szigetköz. The composition of the bed material has been heavily changed, 346,000m^3 silt accumulated in a 4km long section of the side arm from 1992 to 2005. The average sediment thickness on the spawning substrate is 60cm, the upper

third of which consists of fine mud fractions (Rákóczi & Sass 2005). Changes of the spawning substratum can prevent the successful reproduction of sturgeons (Rochard at al. 1990, Auer 1996, Reinartz 2002), therefore the spawning site deterioration may be the main reason of the disappearance of the sterlet in the Szigetköz section of the Danube.

For conservation of the Danubian sterlet population, special and effective rehabilitation measures are needed. The existing legal measures, as temporal fishing ban or size limit cannot guarantee recovery of the threatened species. Restoration of the key habitats is an essential requirement. Considering the endangered Red List status of the sterlet and other sturgeon species, joint efforts of the Danubian countries are indispensable for the effective conservation of the sturgeons.

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Zooplankton (Cladocera, Copepoda) dynamics in the River Danube upstream and downstream of Budapest, Hungary

CS. VADADI-FÜLÖP[1]

Abstract. The spatial distribution and seasonal dynamics of zooplankton (Cladocera, Copepoda) were studied in the River Danube near Budapest, Hungary. The investigated river section was relatively poor in plankton, nauplii dominated. A total of 36 species was recorded of which *Acanthocyclops robustus, Thermocyclops crassus, Bosmina longirostris* were the most abundant. There was a downstream increase in copepod densities, however, no other remarkable differences could be observed between the profiles upstream and downstream of the capital. Generally, the streamline was characterized by lower densities and lower number of taxa as compared to the river bank; nevertheless, there were differences between the left and the right banks both upstream or downstream as well. Seasonal dynamics was defined by a marked late winter–spring aspect and abundance peaks were found to be characteristic for Danube with high densities in May–June and August–September. Examining the relationship between zooplankton density and the hydrological regime, it can be concluded that zooplankton production in the main channel is of minor importance, rather floodplain areas and adjacent water bodies seem to be important sources of plankton biomass.

River Danube, as being the most species rich river in the Palaearctic (Naidenow, 1998), is entitled to great interest, so the research of its plankton means a crucial challenge. The first investigations on the zooplankton of the Hungarian section of the River Danube started in the 1910s with crustaceans (Kottász, 1913; Jungmayer, 1914; Unger, 1916) and continued in the middle of the century (Woynárovich, 1944; Éber, 1955; Ponyi, 1962) mainly with descriptive works. Nevertheless, these studies served as a basis for further research. Dudich (1967) gave detailed information about the fauna of the river Danube. Bothár has broken new ground in the studies of riverine plankton since the 1960s. With research among others on the sampling strategies (Bothár, 1996), on the long-term status of planktonic crustaceans at the area of Göd (Bothár, 1968, 1972, 1988a, 1994, 1996) and on the crustacean plankton near Budapest (Bothár, 1978, 1988b), she has made a major contribution to our better understanding of zooplankton in the River Danube.

In the 1970s and particularly in the 1980s crustacean abundance increased notably, which was best professed by the abundance peaks in summer. The change in species composition and individual numbers implied eutrophication in Danube. However, the hydrological regime has changed as well, which may influence zooplankton assemblages both qualitatively and quantitatively (Bothár, 1985). Towards the estuary, crustacean density increased by 25 fold within the 417 km long Hungarian river section (Bothár, 1988 a). The third period of the Danube plankton research began in the 1990s with the studies of Gulyás (1994, 1995, 1997, 2002) who has extended the research to rotifers. Rotifers dominated the plankton, only copepodites and nauplii were represented in similar abundance.

The most frequent species were characteristic of eutrophicated stagnant waters and rivers of low current velocity (Gulyás, 1994, 1995, 2002). Large abundance of some species and the downstream increase of zooplankton abundance implied increasing eutrophication in the river (Gulyás, 1995). Biomass values measured upstream and downstream of Budapest (near Budapest) were similar, then increased southwards (Gulyás, 1997).

Although numerous studies have been conducted on the zooplankton in the River Danube, relatively little emphasis was put on the transversal distribution of plankton (Bothár, 1978, 1985; Naidenow, 1971, 1979). On the other hand, de-

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tailed surveys have been performed on the horizontal distribution of zooplankton along the river (Bothár, 1973, 1982, 1988 a; Gulyás, 2002; Pujin 1990; Naidenow & Schewzowa, 1990, 1991).

The objectives of this study were (1) to get a comprehensive picture of the crustacean plankton near Budapest, (2) to describe the community structure both from qualitative and quantitative points of view, (3) to present the spatial and temporal changes of microcrustacean plankton considering the hydrological regime as a possible driving force.

MATERIALS AND METHODS

Study sites

River Danube is the second longest river in Europe, it is more than 2800 km long with a catchment area of 817,000 km^2. The Hungarian section occupies 417 km. The middle section is 377 km long and has a relatively balanced hydrological regime, which is controlled by the water discharge of the upper section. In the middle section, current velocity ranges between 0.8–1.2 m sec^{-1} in the upper layers, which can reach the values of 2–2.5 m sec^{-1} during flooding events. The water level fluctuation takes 5–8 m, discharge values range from 500 (low water period) to 6000–8000 (flood) m^3 s^{-1}. The shoreline is mostly regulated, rip-rap is characteristic of this section.

The present study was conducted in the main channel of the River Danube at two profiles upstream and downstream of Budapest (Újpest–-Békásmegyer, 1657 rkm and Tököl–Százhalombatta, 1623 rkm) (Fig. 1). The general characteristics of the two profiles are similar, but the sampling site of Tököl–Százhalombatta is characterized by gravel banks interrupted occasionally with rip-rap, whereas in the profile of Újpest–Békásmegyer rip-rap is the main component. There was no macrovegetation either at the upstrem or at the downstream profile throughout the years. The sampling point of Békásmegyer is situated in the downstream section of the Danube arm of Szentendre, near to the estuary into the main channel.

The study sites were designated on the basis of our objectives, i.e. possibilities for transversal sampling (ferry), and sampling profiles upstream and downstream of Budapest.

Sampling and data analysis

Samples were collected at biweekly intervals from October 2006 to September 2008 at two sampling profiles each containing three sampling sites (stream line, left bank and right bank). Samples taken at the river bank were performed at water depth of some 1–2 metres. During the winter period (between December and February) zooplankton was sampled monthly. 100 litres of water were taken from the surface water layer (upper 50 cm water column) and filtered through a plankton net (50 μm mesh size). The material collected was preserved *in situ* in 4% formaldehyde solution. A total of 270 samples were collected and analysed. Nauplii were counted in 5 ml subsamples in special counting chambers after homogenization. For the taxonomic determination of the animals identification keys by Gulyás and Forró (1999, 2001), Einsle (1993), Amoros (1984) and Dussart (1969) were used. Copepods and cladocerans were identified to species level, however, copepods belonging to the suborder Harpacticoida and ostracods were only counted.

Water temperature was measured *in situ* whereas conductivity was measured in laboratory. Water discharge and water level data (1645.5 rkm) were obtained from the Environmental and Water Research Institute („VITUKI"). Water residence time was calculated with the formula:

$$R = 0.08A_d^{0.6}/Q^{0.1}$$

where R is the residence time at the sampling site (days), A_d watershed area upstream of the sampling site (km^2), and Q river discharge (m^3 s^{-1}) (Soballe & Kimmel, 1987). We used the discharge data measured at Budapest (1646.5 rkm). In order to explore the temporal patterns, cluster analysis and non-metric multidimensional scaling (NMDS) using the Euclidean distance were performed (with standardized data).

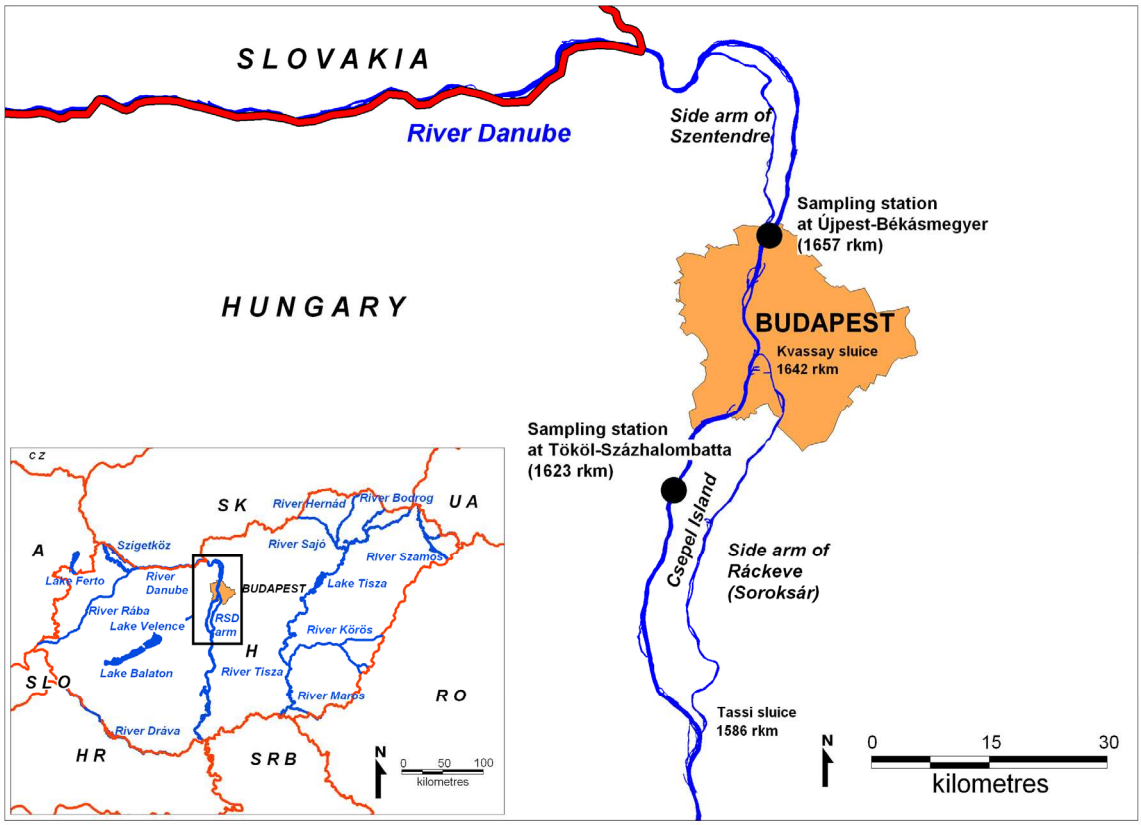
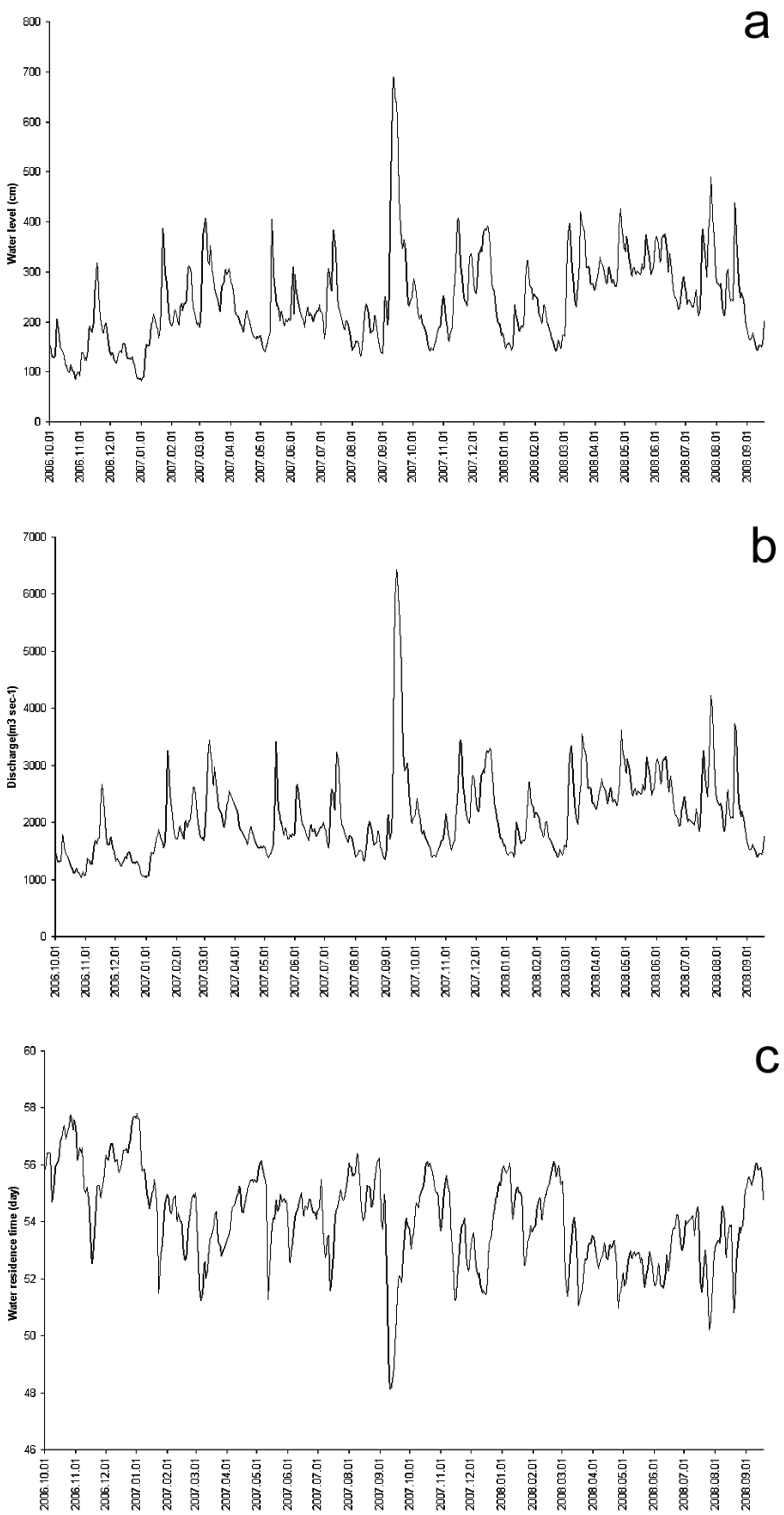


Figure 1. The study area and the sampling sites (●)

Correspondence analysis was applied to demonstrate the relationship between species and sampling sites, that is certain species seem to be more abundant at a definite sampling site. Diversity t-test is a useful tool to compare the diversities of the sampling sites by calculating the Shannon diversity of each sampling site and comparing the diversities statistically. Linear correlation was used to detect any significant association between some environmental variables and zooplankton community. When necessary, data were transformed (log, square root) to obtain the normal distribution. Significant differences were identified at $p < 0.05$. All data analyses were performed using the PAST program (Hammer *et al.*, 2001).

RESULTS

During the study period, water level varied between 83 and 689 cm-s, maxima were recorded in September of 2007. This marked peak was two times higher than other peaks. Low water level occurred in the year of 2006, whereas relatively high water level persisted in spring and summer of 2008. Discharge values (ranged between 1030 and 6420 m^3 sec^{-1}) strongly followed this pattern. Despite some deviations, the annual discharge pattern typical of river systems in the temperate region was observed with low water period in autumn and winter, and discharge peaks in early and late spring. Water residence time ranged between 48 and 58 days (Figs. 2 a–d). Water



Figures 2 a–c. Hydrological parameters recorded during the study period. a = water level, b = discharge, c = water residence time

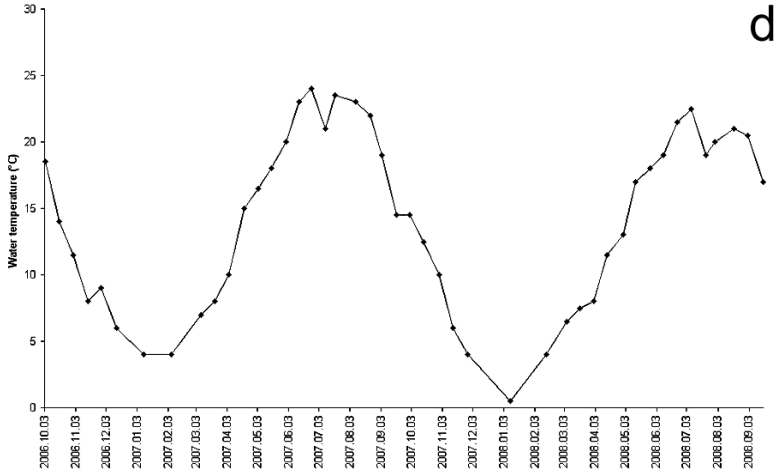


Figure 2 d. Water temperature recorded during the study period

temperatures showed typical annual cycle, maximum values were observed in June–August (23–24°C) and minimum in January (0.5 °C). There was a negative relationship between water level and conductivity both upstream ($r = 0.40$; $p = 0.0073$) and downstream ($r = 0.38$; $p = 0.0118$) of Budapest over the study period.

A total of 36 species were observed of which 11 belonged to copepods and 25 to cladocerans (Table 1). *Diacyclops crassicaudis* was recorded for the first time in the Hungarian section of the River Danube. The occurrence of *Diaphanosoma mongolianum* in the main channel of the Danube is new, as it was only reported from the Szigetköz backwaters and few water bodies respectively (Gulyás & Forró, 1999). Frequent species included *Acanthocyclops robustus, Thermocyclops crassus, Bosmina longirostris, Alona rectangula, Chydorus sphaericus*, moreover harpacticoid copepods were also determining. The species number in the streamline was similar upstream and downstream (17–16 species), 10 common species were recorded. The distribution of the species number within the sampling profile was more dispersed downstream with a maximum of 30 species detected at Tököl. The relative abundance of nauplii was mostly greater than that of other zooplankton groups, whereas adult copepods and copepodites were represented in similar abundances. Cladocerans contributed up to 19.5% of the total density upstream of Budapest and 18.1% downstream, respectively.

The percentage compositions of the zooplankton community upstrem and downstream of the capital are presented in Figs. 3–4. There is evidence of a remarkable downstream increase in copepod densities meaning that adult copepod densities became doubled and copepodit densities increased by 18%. This phenomenon is mainly due to the fact that the relative contribution of *Thermocyclops crassus* increased considerably at the downstream profile, although calanoid densities increased as well. Such notable longitudinal differences cannot be seen either in cladoceran community composition, or in nauplii.

Generally, the streamline was characterized by lower individual numbers and lower number of taxa in comparison with the river bank (Table 2), however, there were also differences between the left and the right banks both upstream or downstream of Budapest. Average densities ranged between 5.08 and 12.96 ind./100 litres, whereas maximum density reached 87 ind./100 litres at Békásmegyer. Note that nauplii densities are included as well, these results suggest that the river is poor in planktonic crustaceans. Regarding diversities it seemed to be essential to present the

Table 1. Zooplankton taxa recorded in the River Danube (October 2006 to September 2008) and their codes. Abbreviations: B: Békásmegyer (right bank); UBS: Újpest–Békásmegyer streamline; U: Újpest (left bank); Sz: Százhalombatta (right bank); TSzS: Tököl–Százhalombatta streamline; T: Tököl (left bank)

Taxa	Code	B			UBS			U			Sz			TSzS			T		
		06	07	08	06	07	08	06	07	08	06	07	08	06	07	08	06	07	08
CLADOCERA																			
Alona affinis (Leydig, 1860)	Aaff			+						+						+			+
Alona guttata Sars, 1862	Agut		+															+	
Alona intermedia Sars, 1862	Aint		+																
Alona quadrangularis (O. F. Müller, 1785)	Aqua	+	+			+			+	+		+	+					+	
Alona rectangula Sars, 1862	Arec	+	+	+	+	+			+			+	+	+		+		+	
Bosmina coregoni Baird, 1857	Bcor																		+
Bosmina longirostris (O. F. Müller, 1785)	Blon		+	+	+	+	+		+	+		+	+		+	+		+	+
Chydorus sphaericus (O. F. Müller, 1776)	Csph	+		+		+	+	+	+	+			+		+	+			+
Daphnia cucullata Sars, 1862	Dcuc		+			+	+		+	+		+	+		+	+	+	+	+
Daphnia longispina O. F. Müller, 1785	Dlon		+			+			+						+				+
Diaphanosoma brachyurum (Liévin, 1848)	Dbra		+						+										
Diaphanosoma mongolianum Uéno, 1938	Dmon												+						+
Disparalona rostrata (Koch, 1841)	Dros						+		+	+			+						+
Graptoleberis testudinaria (Fischer, 1848)	Gtes		+																
Iliocryptus sordidus (Liévin, 1848)	Isor			+						+		+	+		+				+
Leydigia acanthocercoides (Fischer, 1854)	Laca																	+	
Leydigia leydigi (Schoedler, 1863)	Lley								+			+							+
Macrothrix hirsuticornis Norman & Brady, 1867	Mhir			+					+	+		+	+			+			+
Macrothrix laticornis (Fischer, 1848)	Mlat								+									+	
Moina macrocopa (Straus, 1820)	Mmac		+						+										
Moina micrura Kurz, 1874	Mmic		+			+	+		+			+	+					+	+
Pleuroxus aduncus (Jurine, 1820)	Padu											+						+	
Scapholeberis mucronata (O. F. Müller, 1785)	Smuc		+				+			+						+			
Sida crystallina (O. F. Müller, 1776)	Scry																	+	
Simocephalus vetulus (O. F. Müller, 1776)	Svet		+																
COPEPODA																			
CALANOIDA																			
Eudiaptomus gracilis (Sars, 1863)	Egrac					+							+					+	+
Eurytemora velox (Lilljeborg, 1853)	Evel		+						+	+		+	+		+	+		+	+
CYCLOPOIDA																			
Acanthocyclops robustus (Sars, 1863)	Arob		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Acanthocyclops vernalis (Fischer, 1853)	Aver														+				
Cyclops strenuus Fischer, 1851	Cstr									+	+	+						+	+
Cyclops vicinus Uljanin, 1875	Cvic			+			+			+									+
Diacyclops crassicaudis (Sars 1863)	Dcra						+												
Eucyclops serrulatus (Fischer, 1851)	Eser		+	+		+	+			+		+	+			+		+	
Mesocyclops leuckarti (Claus, 1857)	Mleu		+																+
Paracyclops fimbriatus (Fischer, 1853)	Pfim		+				+		+	+								+	
Thermocyclops crassus (Fischer, 1853)	Tcra		+	+		+	+		+	+	+	+	+		+	+		+	+
HARPACTICOIDA	Har	+	+	+		+	+	+	+	+	+	+	+		+	+	+	+	+
OSTRACODA	Ost		+						+	+						+		+	

Table 2. Major ecological parameters of the zooplankton community (n = 44). Density data include nauplii as well. For the abbreviations of the sampling sites see Table 1

Sampling site	B	UBS	U	Sz	TSzS	T
Average density (ind./100L)	8,48	6,80	9,82	9,17	5,08	12,96
Maximum density (ind./100L)	87,00	49,00	43,00	46,00	22,00	60,00
Taxa S	26,00	17,00	25,00	19,00	16,00	30,00
Dominance D	0,23	0,13	0,08	0,11	0,13	0,14
Shannon H	2,21	2,31	2,83	2,52	2,32	2,48
Evenness e^H/S	0,35	0,59	0,68	0,66	0,64	0,40
Berger-Parker	0,45	0,26	0,16	0,19	0,21	0,25

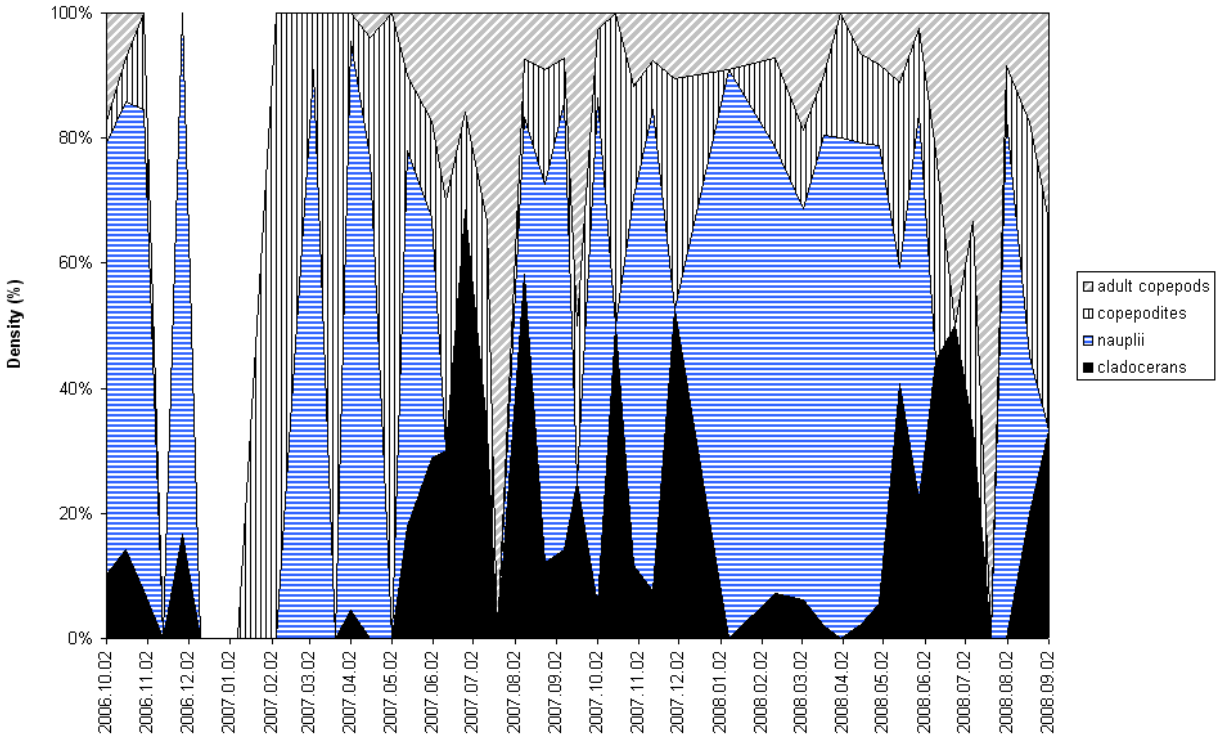


Figure 3. The percentage composition of the zooplankton community upstream Budapest. Results include data obtained from the streamline, left and right river banks (summed)

results of two different diversity indices. Shannon diversity values ranged within a relatively close interval (2.21–2.83), highest diversity and eveness values were measured at Újpest. Berger–Parker diversity peaked at Békásmegyer where the Shannon diversity was the lowest, which is due to the dominance of some species (dominance D = 0.23). Based on the diversity t-test, sampling station Újpest (U) differed significantly from the others (U-B: $t = 3.89$, $p<0.001$, U-UBS: $t = 3.77$, $p<0.001$, U-Sz: $t = 2.29$, $p = 0.02318$, U-TSzS: $t = 3.68$, $p<0.001$, U-T: $t = 2.54$, $p = 0.0156$). One more significant difference included Békásmegyer–Százhalombatta ($t = 2.32$, $p = 0.0214$).

The correspondence analysis (Fig. 5) suggests that the sampling site Békásmegyer, which is situated in the side arm of Szentendre, has specific features. The high individual numbers of *Moina micrura* and the presence of *Simocephalus vetulus, Alona guttata, Mesocyclops leuckarti, Graptoleberis testudinaria* are responsible for its separation. The sampling site Újpest (U) is also determined by the presence of several taxa. The sampling profile downstream of Budapest seems to form one group, although the sampling site Tököl (T) has some characteristic elements, e. g. *Bosmina coregoni, Sida crystallina* and it is dominated by *Thermocyclops crassus*.

Examining the temporal patterns of the zooplankton assemblage, no clear trajectory could be detected, however, there was a marked late winter-spring aspect (marked) with great similarities among samples. Samples taken in summer and autumn form a second group, but are far more dispersed (Fig. 6). Species number was low during the winter and increased in late spring, then remained relatively high during the summer months and decreased in autumn. Total abundance, however, peaked in spring of 2008 and in summer of 2007. The seasonal dynamics can be characterized by two population peaks within the year, the first in May–June, the second in August–September.

The seasonal patterns were similar between the upstream and downstream sections, with a positive correlation of the zooplankton community density between the two sampling profiles over the study period ($r = 0.58$; $p<0.001$). A strong positive correlation was detected between water temperature and zooplankton density at Tököl-Százhalombatta ($r = 0.35$; $p = 0.0178$), but not at Újpest-Békásmegyer, however, zooplankton density without nauplii was positively related to water temperature ($r = 0.42$; $p = 0.004$). Zooplankton density (without nauplii) was positively correlated with water level ($r = 0.32$; $p = 0.0303$) and discharge ($r = 0.32$; $p = 0.0307$) and negatively correlated with water residence time ($r = 0.32$; $p = 0.0305$) at the upstream section. However, these relationships were not significant at the downstream profile.

DISCUSSION

The time available for zooplankton to develop was esimated at 48–58 days (an estimate of the time the water has been in the river system) assuming that plankton drifts with the current passively. During this time 5 generations of cladocerans and 1 or 2 generations of copepods may develop (Naidenow, 1998). The growth is supposed to depend on the hydrological regime (increased residence time favours zooplankton, that is zooplankton benefits from low water velocity). This is not only due to the mechanical effect of the drift, but it is connected with the fact, that suspended matters have a negative impact on planktonic crustaceans (Zsuga *et al*., 2004; Gulyás, 2002;). However, we have found a negative relationship between water residence time and zooplankton density and a positive relationship between water discharge and zooplankton density, which strongly suggests that zooplankton production in the main channel is of minor importance, which is consistent with the findings of Reckendorfer *et al*. (1999). Floodplain areas and adjacent water bodies seem to be rather important sources of plankton biomass (Saunders & Lewis, 1989; Naidenow 1998; Schiemer *et al*. 2001; Zsuga *et al*., 2004). The positive correlation of zooplankton density with water level also seems to support this hypothesis. According to Reckendorfer *et al*. (1999), the physical interaction of flow regime and river margin morphology determines the availability of inshore storage zones and the rate at which plankton are added to the main river channel.

The dominant species that were found in the present study in the main channel (*Acanthocyclops robustus, Bosmina longirostris*) are consistent with the findings of Bothár (1985, 1988 b, 1994) and Gulyás (1994, 1995, 2002), however, the relatively large contributions of *Thermocyclops crassus* and Harpacticoida are new. Two thermophyl species, *Thermocyclops crassus* and *Moina micrura* are reported to become abundant in the River Danube since 1971 (Bothár, 1975), but they were regarded only as secondary species at Göd (rkm 1669) (Bothár, 1985). The relatively

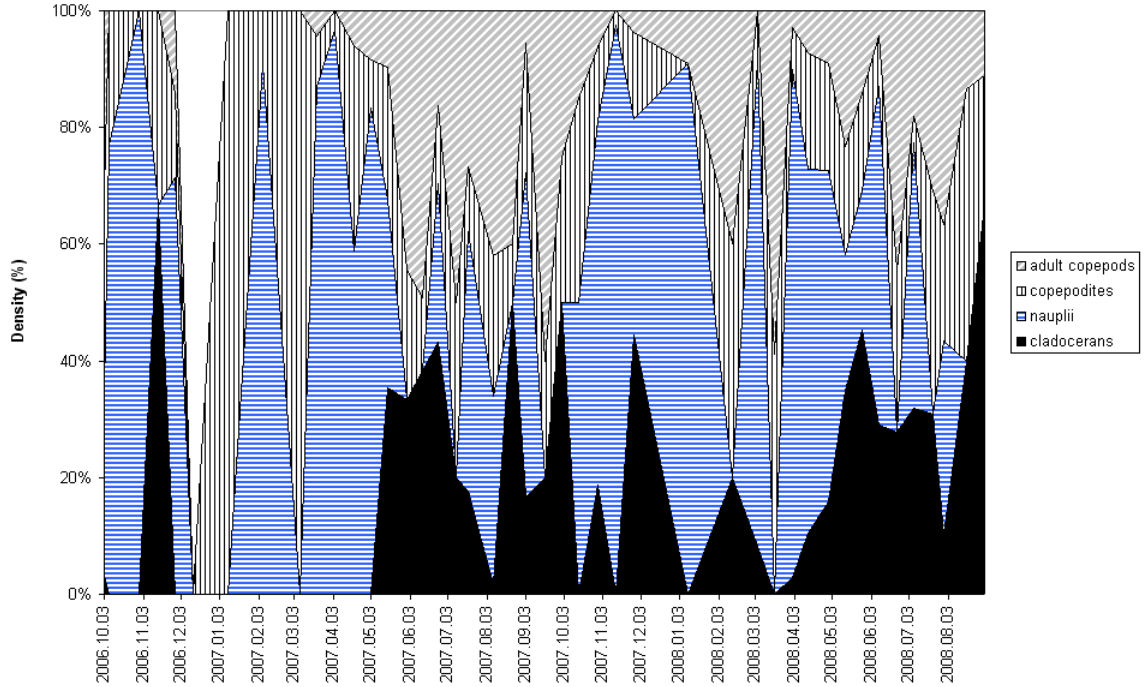


Figure 4. The percentage composition of the zooplankton community downstream Budapest. Results include data obtained from the streamline, left and right river banks (summed)

large frequency and abundance of *Thermocyclops crassus* may be related to the changing hydrological regime and increased temperature. Beyond the above-mentioned, there is no evidence of any significant long-term changes in species composition. The population peaks observed in the present study (May–June, August–September) are in line with the results of Bothár (1985, 1978), Bothár and Kiss (1990) and Gulyás (1995). Regarding densities, the examined river stretch was poor in plankton, the individual numbers were similar to the findings of Bothár *et al*. (1971) and Bothár (1978) at Újpest–Békásmegyer in the 1970s, at Adony (1598 rkm) in the 1980s (Bothár, 1988b), but not to that of Göd (Bothár, 1994). In quantitative aspect, contrasting my results to that of Gulyás (1994, 1995, 1997) is not meaningful since the author presented the overall densities (with rotifers).

There were no remarkable differences between the upstream and downstream sections, only copepod density increased downstream. This does not support the hypothesis that municipal and industrial wastewaters of the capital may create significant impact on zooplankton assemblages downstream Budapest. Bothár (1988) has observed lower maximum densities and different seasonal dynamics patterns downstream of Budapest. According to the author, these differences can be explained by the effects of wastewaters and changed stream conditions due to the regulated river bed and the side arm of Szentendre. Nevertheless, Gulyás (1997) has not found any remarkable differences between the upstream and downstream sections. Although the examined river stretch is poor in planktonic crustaceans, the recorded species and their contributions to the total density suggest that the river has a moderately rich fauna with several tichoplanktonic elements. The latter also implies for the significance of inshore storage zones.

The spatial distribution of zooplankton across the river was not equal, the streamline was characterized with lower densities and lower number

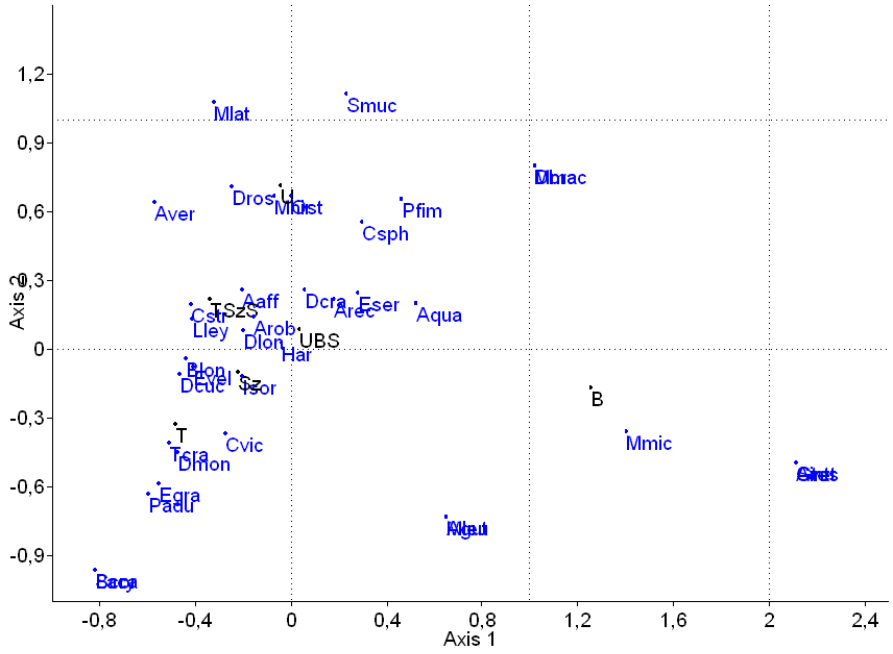


Figure 5. Biplot of the correspondence analysis. Codes of the taxa are presented in Table 1. Abbreviations of the sampling sites: B-Békásmegyer; UBS-Újpest-Békásmegyer streamline; U-Újpest; Sz-Százhalombatta; TSzS-Tököl-Százhalombatta streamline; T-Tököl

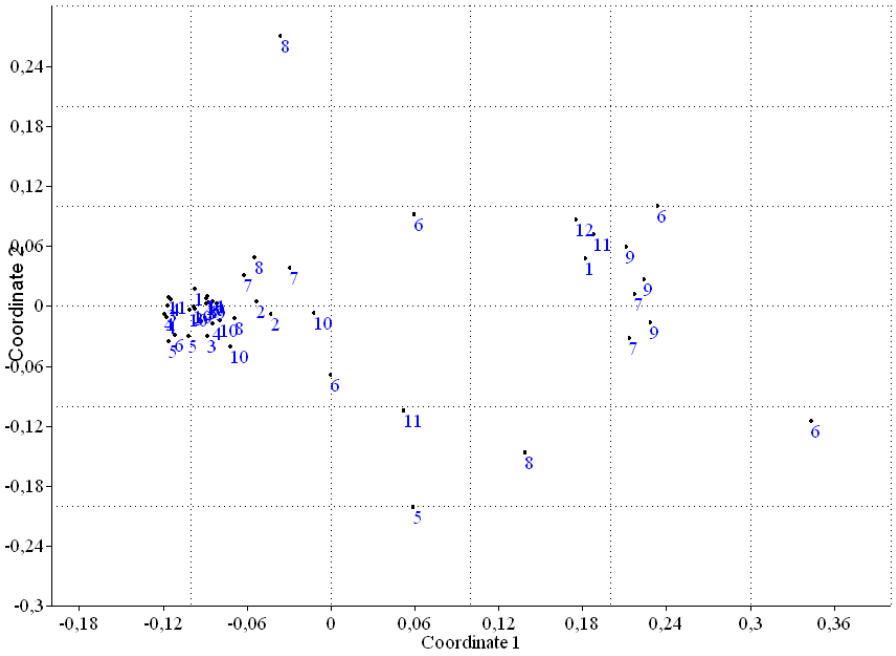


Figure 6. NMDS plot of the samples. Numbers represent the months: 1-January; 2-February etc.

of taxa. Similarly, densities were often found to be higher nearshore (Bothár, 1978, 1985; Thorp *et al*., 1994; Mitsuka & Henry, 2002).

In summary, my results pointed out the evidence of spatial heterogeneity across the river, however, save adult copepods no major difference was detected between the upstream and downstream sampling profiles. The author stresses the importance of adjacent lentic areas as sources of planktonic crustaceans.

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